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**Illustrated.*

The Engineering and Mining Journal

APRIL 29, 1911.

A Zinc Ore Tariff Decision

The first zinc-ore case to come up under the new tariff has just been decided by the U. S. Court of Customs Appeals. This was a case in which the Consolidated Kansas City Smelting and Refining Company appealed from a decision of the Board of General Appriasers affirming the assessment of duty on both lead and zinc in some importations of ore containing lead in large or small percentage, and each containing over 10 per cent. of zinc. The Court of Appeals decided that the language of the Payne-Aldrich tariff was explicit in this matter and that the zinc content, if over 10 per cent., of a lead ore is dutiable as well as the lead content thereof. In this decision the court manifested the policy that has always been apparent in such cases, namely, that a tariff act is to be construed upon the language appearing in the act, and not upon any attempt to show what may or may not have been the intention of Congress.

The importers would have made out a stronger case, we think, if they had relied more upon Section 24, which provides that ores may be imported in bond and that the several charges against such bond may be canceled upon the exportation or delivery of the actual amount of lead produced from the ores. Upon the face of the language, which the Court holds to be governing, if the importer had reëxported the lead derived from the ore in question, he would have been able to cancel the duties against the zinc. The record in the case, however, does not show that the importer proceeded under this section.

The history of the last two or three years has shown that the tariff on zinc ore was of no use to anybody, and we doubt if its advocates would urge it any longer. Without being of any advantage as a protective measure, it is an impediment to legitimate business. It is open to much legal dispute, but in view of the spirit of the times, indicating the early abolition of some of these imposts, it will probably not be worth the while of anybody to enter into protracted litigation over this matter.

The Tonopah-Belmont Surface Plant

The Tonopah-Belmont surface plant, described in this issue, comprises several new points. The most novel of these is the hoist house, which is built with a saw-tooth roof, such as is commonly used in factory construction in the East. In this way the hoist room is admirably lighted, without the use of numerous side windows, which sometimes cause the attention of the hoisting engineer to be distracted. Moreover, the absence of side windows causes the hoist room to become less of a lounging place in cold weather than often happens. Of more importance, however, the hoisting engineer is given an unobstructed view of the headframe, as the saw-tooth roof enables the front of the building directly facing the engine to be entirely covered with glass.

One of the new forms of reinforced-concrete construction has been used in the buildings as much as possible. The ore bins also are designed along rather new lines. Taken all in all, the Tonopah-Belmont is a noteworthy plant and ranks among the best in the country, and Frederick Bradshaw, the general superintendent, to whom most of the features of the plant are due, deserves much credit for his efforts.

It is regrettable that such an unfortunate accident as that of the fire of a month ago should happen at a mine where so much is being done for the comfort and the safety of the men. But most unusual conditions existed in the mine, for it has been necessary to develop the new orebody through the Desert Queen shaft while a new shaft, the Belmont, where the modern surface plant has just been installed, was being prepared. On account of the distance

of the new orebody from the old shaft, it was not thought advisable to drive to the ore on more than one level, and so the new orebody was developed below the 1000-ft. level by means of workings from an incline winze. Moreover, the difference in altitude between the collars of the two shafts is only approximately 60 ft. The fire at first appeared to be unimportant, and no one thought of the likelihood that a fire would cause the ventilation to reverse under these unusual conditions. If that had not occurred, there would probably have been no fatalities, but it did and quite suddenly, so that bosses and men were likewise trapped. This unfortunate happening teaches that a mine fire should never be viewed as anything but important until it is extinguished, and everyone should act in that manner whenever a fire, no matter how trivial it may appear, is found in any mine working.

Wireless Telegraph for Mines

In our pages devoted to practical details, last week, there was described a simple wireless-telegraph installation that might be used especially at those mines situated in remote regions having no direct means of communication with the outside world. So far as we know, no mine is as yet equipped with a wireless-telegraph station, but several years ago the owners of a group of mines in the Pis-Pis district of Nicaragua considered the installation of such a plant; for some reason the idea was not carried into effect.

These mines are well situated for wireless communication with the stations of the United Fruit Company, which are now being operated at Limon, Costa Rica; at Bluefields, Rama and Cape Gracias, in Nicaragua; at Cape San Antonio, Cuba; at Swan island, and at several places on the coast of Honduras.

The Nicaraguan mines are accessible only after a long and tedious trip up shallow rivers and the dense forest growth precludes the construction of telegraph lines. There are suitable sites for the erection of aërials so that there would be no hills intervening between sending and receiving stations. The distance to the nearest station on the coast is less than 150 miles and as there is abundant electric power available at one of the mines, the quantity of power necessary to transmit messages would not be an obstacle.

In Peru an overland wireless system has long been in commercial and government use between Iquitos, on the Amazon, and Puerto Bermudez, on the Pichis river. The stations are both about 600 ft. above sea level and are separated by about 500 miles of impenetrable jungle and an intervening range of the Andes, attaining an altitude of 15,000 feet.

Conditions in the remote regions are even better for wireless operation than they are near the centers of civilization, because there is little or no interference from the proximity of other stations.

The possibility of bringing remote mines into closer connection with the centers of civilization, adds greatly to the attractiveness of their exploitation. When the first of such mines is equipped with a wireless installation, it will, no doubt, act as a stimulus to the exploration of those regions, the remoteness of which is an obstacle to development.

Lake Iron Ore Prices

The long deferred settlement of prices of Lake Superior iron ore for the season has at last been effected. For obvious reasons there has been ostensibly no general agreement; but the largest ore-selling interest has made large sales at a reduction of 50c. per ton from the season prices of 1910. As this action was taken after conference with others, it obviously sets the pace for the season and may be said to establish the prices. For the merchant furnaces using Lake ore this means a reduction of approximately $1 per ton on the cost of their iron, after they have used up their present stocks.

The new schedule ranges from a basis of $4.50 for Old Range bessemer ores, 55 per cent. iron—the highest grade—down to $3.50 for Mesabi nonbessemer, 51.5 iron. These prices are delivered at Lake Erie ports; and deducting railroad freight to Lake Superior and vessel freight on the Lakes, the return to the mines varies from $2.50 down to $1.75, from which must be met mining costs, royalties and general expenses. It is obvious that not a very large amount will be left to represent the value of the ore in the ground.

It is, perhaps, not altogether because iron-making is dull and the prospect of immediate improvement rather dubious, that prices have been reduced. In the past two or three years there has been a large increase in the consumption of Eastern ores and of ores imported from Cuba, Spain and Sweden. Now furnaces close to the seaboard will naturally use these ores; but there is what might be called a neutral zone, in which furnaces use either Lake or other ores as they find it most advantageous. This zone contains a large proportion of merchant furnaces and in the last two or three years they have found imported and Eastern ores the cheapest and best for their use. The production of iron ores in the East has been increasing, especially the Clinton ores of New York, and they have found a ready market; while imports of ore increased over 50 per cent. It is quite probable that Lake sellers hope to recover lost ground in this neutral zone; but they must have some coöperation from the railroads.

After all, fixing prices for Lake Superior ores is not as important a matter as it used to be. The large steel companies own their mines, and the price of ore to them is the cost of mining and transportation, with the necessary charges for depreciation and depletion of resources. The buyers of ore are nearly all merchant furnaces—that is the furnaces which make pig iron and sell it in that form. They make rather less than 30 per cent. of the pig iron in this country, and some of the larger concerns own the mines from which they draw their supplies of ore. Making necessary allowance for these and for furnaces in the East the proportion of Lake ore sold as ore must be little, if any, over 15 per cent. of the total. Even this proportion is a considerable quantity, and the price paid for it is a matter of importance to the buyers. In some cases it is a question of success or failure, of profit or bankruptcy.

The corrected returns from Tasmania for the year make the total production of gold 37,048 oz. in 1910, which was somewhat less than the preliminary estimate used in our article on "Australasian Gold" in the JOURNAL of Feb. 25. This reduces the total gold output of Australia and New Zealand in 1910 to 3,268,139 oz., or $67,552,433; a decrease of $3,701,749, or 5.2 per cent., from the previous year.

Metallics

Don't feed oil to an air drill as if it were a cathartic. Give small doses at frequent intervals.

In all chilled-slag analyses, rub the slag first with distilled water, in order to prevent it from sticking.

When wire ropes are used for cage guides they should be weighted unevenly in order to minimize any tendency to vibrate in unison.

In installing a long pipe line be liberal in the use of flange couplings. It may be necessary to take out a piece of the pipe at the center of the line some day.

The use of chrome- or manganese-steel parts for sampling machinery costs less per ton sampled than do cast-iron, besides contaminating the sample less.

Blacksmiths unaccustomed to using Swedish steel try to work it at too high a heat, frequently making poor welds, or burning the material. American blacksmiths are prone to work all steel at too high a heat.

The Krupp tube mills of the San Rafael y Anexas company at Pachuca, Mex., are 1.2 m. in diameter by 6 m. long; they make 31 r.p.m., require 39 h.p. and grind 45 tons of sand per day. The consumption of French flint pebbles is 2.284 kg. per ton of sand ground.

More drills are ruined from grit carried to the cylinder from the end of the air hose after it has been lying on the floor than from any other cause. Before attaching, blow out the hose at full pressure, then play directly on the drill attachment to blow off all grit possible.

A simple counterweight which has given good satisfaction in balancing skips or cages in vertical shafts, consists of an 11-in. piece of steel shafting which slides in a 12-in. cast-iron pipe. There is no possibility that anyone will thrust an arm in the way of danger, and the difficulties arising from air currents can be satisfactorily handled.

Cross drill bits, sharpened by hand, were found unsatisfactory in the Joplin mines, where the ore is hard and flinty. The gage was quickly lost, which was not so marked with hard sharpened "bull" or chisel bits. When drill-sharpening machines were introduced, the cross bits were found to hold their gage better than the hand-made bull bits.

For use with leaf filters, wet-vacuum pumps without intermediate receiver have been found satisfactory and capable of maintaining a vacuum up to 27 in. These pumps are usually of 8½ in. diameter, single cylinder, 10-in. stroke, double-acting up to 40 r.p.m., according to the number of frames to which they are connected. They are fitted with vacuum and air chambers to promote uniform action. The pistons are of the trunk type, using square packing.

By the Way

Another swindling promoter has come to grief, this time one J. M. Graybill, who has been convicted at Los Angeles of using the mails to promote a fraudulent mining scheme in connection with the Greenwater-Ely Consolidated Copper Company.

The occupation of the miner, according to the statistics of the insurance actuaries, is more dangerous than soldiering. This is probably the reason why some miners adopt the latter as their avocation—or vocation if it looks that way to you.

A correspondent writes as follows, under date of April 16, regarding the proposed merger of the mines of the Pioche district in Nevada: "There was something wrong with the fuse or the cap or the priming of the big 'merger' boom, and a missed hole is the result. Latest reliable information is that the contending parties are beginning to make overtures for peace."

The spring breakup is now on at Porcupine and practically no further supplies or equipment of a heavy nature will be taken into the district until the completion of the railroad in July. Most of the larger operators have taken in such supplies as shall be needed in the interim. The snow is beginning to melt and an era of mud and comparative quietude is now due. The incorporation of million-dollar companies, however, will probably go merrily on.

"What's in a name?" asked some sage, prophet or poet (we forget whom). Nothing much, perhaps. Yet in mining it appears that the real concerns have simple names, such as the Butte Copper Company, the California Mining Company, etc. A perusal of any list of the concerns that are brought out to entrap the unwary will show a different class of titles, such as the Mount Pisgah Gold, Silver and Diamond Mining, Milling, Smelting and Refining Company. The fraudulent promoters seem to run to the highfalutin'. Probably in their study of psychology they have learned that the gudgeons like such bait.

As in clothes, there are fashions in mining and metallurgy. Two or three years since "porphyry coppers" were in the hight of fashion, and a favorable-looking gold property was, like Thisbe, "a gray eye or two, but not to the purpose." Stock brokers a few years ago listened abstractedly to gold-mining ventures and then said, "Yes, that's very good, but haven't you something in coppers." Today, however, the red metal is out of fashion. Now it must be a tale of gold to attract attention and the fashionable resort is Porcupine. Any other place at the moment is of no consequence. One may have a good strong vein on the Mother Lode or a high-grade showing in Nevada, but it's of no use unless one can move it to Porcupine. Porcupine has become the Mecca and the pilgrims have come from Arizona, South Africa and the Klondike. Real estate there is golden and swamps are to the uninitiated as great in possibilities as the proven orebodies of Hollinger and Dome. Mere acres are capitalized for a million or two. The speculative fever has shot up the price of claims to the point where experienced mining concerns find it imprudent to enter further into this district at present. While some prizes have already been drawn and more are probably still to be unearthed in Porcupine, we fear that many will find only quills. The new goldfield is an attractive one, but as in every new camp, the way of the investor is not easy. If he expects to be successful there, he must exercise good judgment and secure competent advice.

We note in a recent published prospectus on a Mexican property, a report by an engineer personally unknown to us, but presumably someone more or less experienced in the business, for he prefaces his report with the following verbiage: "TO WHOM IT MAY CONCERN: I, ————, a duly authorized mining engineer and disinterested party, do hereby make and submit the following report, made from a personal examination of a certain mining property known to me as the ——— group of mines, and I, the said ————, do bind myself by these presents, for and in consideration of the conditions herein named, to assist any interested party at any convenient time in making a joint reëxamination of the above-named property. And if all statements shown or made in this report cannot be reasonably corroborated in said joint examination I hereby agree, in that event, to make no charge for my expense and services while thus engaged, but shall receive a fair compensation for such service providing my work is found practically correct." The same engineer, discussing the geology and topography of the interesting property on which he reports, states: "Every feature of the Durazno ledge goes to show it to be a true-fissure ledge supported by one of our most popular and reliable formations from which the metals of many districts depend on. This formation is not as commonly faulted as many other kinds of ore-bearing rocks. Everything seems to be in place in all exposures." We would commend the affadavit as being a novel idea and we recommend that the geology be revised, although indeed it is very interesting as it stands. Such phrases, however, as "one of our most popular and reliable, etc.," are likely to be confused with the description of the bridegroom in the village paper or of the candidate for city clerk, and on this account, if no other, should be avoided.

Lead Smelting in Bond

WASHINGTON CORRESPONDENCE

Important action has just been taken by the Treasury which has issued new regulations governing operations in bonded smelting warehouses. Section 24 of the tariff act provides that the works of manufacturers engaged in smelting or refining, or both, of ores or crude metals may be bonded as bonded smelting warehouses, and the section further provides that the several charges against such bonds may be canceled upon the exportation or delivery to a bonded manufacturing warehouse established under Section 23 of the act of the actual amount of lead produced from the smelting or refining, or both, of such ores or crude metals, and further provides, that the said lead may be withdrawn for domestic consumption upon the payment of the duties chargeable against it in that condition.

The department's new regulations, governing the working of this section are briefly as follows:

Upon the importation of lead-bearing ores, the warehouse bond is charged with the lead contained therein, as shown by assay at the rate of 1½c. per lb. under paragraph 181, and upon the importation of base bullion, the warehouse bond is charged with duty at the rate of 2⅛c. per lb. under paragraph 182, upon the gross weight of the bullion, and an assay is made thereof for the purpose of determining the amount of lead in the bullion.

As Section 24 provides for the cancelation of the bond upon the withdrawal from the warehouse of the actual amount of lead produced, and as there is necessarily a wastage in the smelting or refining of the ores or base bullions, the assay is made of the product withdrawn for transportation or exportation, and to the quantity of lead, as shown by this assay, is added the amount of lead wasted in the smelting or refining, and this weight is applied to the cancelation of the warehouse bond.

If the product, however, is withdrawn for consumption, duty is assessed upon the gross weight of the product at the rate of 2⅛c. per lb., for the reason that Section 24 provides that the lead withdrawn for consumption shall pay the duty chargeable against it in that condition, and its condition is obviously either base bullion or refined lead.

In some cases, the operations of smelting and refining are not carried on in the same establishment, that is, the smelting is done in one warehouse and the refining in a warehouse in another port.

The withdrawal for transportation from the first port shows the gross weight of the base bullion and duty is extended thereon at the rate of 2⅛c. per lb., and upon its arrival at the port where the refinery is situated, it it rewarehoused, the rewarehouse entry being based on the withdrawal for transportation, the bond chargeable accordingly and an assay made of the base bullion at that port.

Upon the receipt of the assays of the base bullion by the collector at the first port, the warehouse bonds are given credit, that is, credit is given on the bonds for the actual lead produced by the smelting of the imported ores and covered by the warehouse entries, based upon the assays of such ores, to which is added the wastage allowance established for the smelting of ores at that plant.

When the base bullion so transported to the second port has been refined and exported, or withdrawn for consumption, the rewarehouse bond is canceled.

Miami Copper Company

According to the report of this company for the year ended Dec. 31, 1910, the expenditure on mine development had been $1,094,100; on mill construction, $1,204,919; on power plant, $512,155; on miscellaneous equipment, $66,990; on mine buildings and improvements, $99,902; on dwelling houses, $114,084; on pipe line and water development, $247,907; on equipment of No. 4 shaft, $64,510.

In the development of the mine, underground workings of a total length of 78,388 ft. have been driven, yielding 251,000 tons of ore. During 1910 the orebody was further prospected by churn drilling, 29 holes being sunk, of which 14 showed ore of good grade. The remainder were all in mineral-bearing ground, but the ore found carried less than 1.5 per cent. copper, and for the present, at least, this is disregarded. By means of drill holes and underground work the company has now explored 58 acres out of the 222 acres classified as mineral-bearing. Of the ground explored, 15 acres are considered too low in grade to be classed as ore. In the remainder there is estimated to be fully proved 18,000,000 tons of ore averaging 2.58 per cent. copper.

One section of the concentrating mill was put in operation on March 15, another section going into commission a few days later. It is expected that section 1 will be put in operation on April 20, and section 4 on May 10. Sections 5 and 6 will not be completed until later in the year.

Each section is of a nominal capacity of 333 tons per 24 hours, but sections 2 and 3 have already been doing 400 tons per section and it is expected that the real capacity will be 500 tons per section. This will give the mill a total capacity for the treatment of about one million tons of ore per annum, expected to yield about 40,000,000 lb. of copper, besides which the foundations for three more sections have already been laid.

The two sections now in operation have been running partly on ore from the dump and partly from ore extracted in the course of development work. The feed to the mill has been averaging about 2.57 per cent. copper, of which a recovery of about 74.5 per cent. is already being obtained, corresponding to a yield of about 38 lb. per ton. It is expected that a yield of 40 lb. per ton will be obtained.

On Dec. 31, 1910, the company had on hand supplies to the amount of $232,369; accounts receivable, $41,064; and cash, $351,059. Accounts payable amounted to $142,284.

Indian Demand for Gold

Messrs. Samuel Montagu & Co. write from London under date of April 13: "Hon. Edwin S. Montagu, under secretary of state for India, in an interesting reply to questions in the House of Commons stated that the Government of India considered 'that in their opinion the balance of evidence supported the conclusion that the use of sovereigns as currency was increasing' and added 'no attempt was made in India to force gold into circulation.'

"The denial in the last quotation was hardly necessary. The boot is on the other leg—it is the Indian native who is forcing supplies of gold—coined and otherwise—into the country. This desire on their part is the natural outcome of the makeshift system which was adopted when the mint was closed to free coinage of silver. The thinking part of the community recognize that they possess an asset in sovereigns superior to the silver currency of the country, for the treasury is bound to give out rupees against gold, but not *vice versa*. It is possible that the desire to rehabilitate the silver rupee may impel the Indian government to devise some method by which the tendency to drive the rupee out of circulation may be arrested.

"The whole currency scheme of India is a compromise, and if it result in the imposition of a duty upon imported gold —an operation economically unsound in normal conditions—the innovation would be most remarkable, and the extraordinary position might be witnessed of an import tax upon both gold and silver at the same time.

"In any case, the basis of 16d. per rupee for the exchange is not in the least endangered; for, whatever difference of opinion might have existed as to the closing of a free mint for silver, the government has succeeded in maintaining a steady exchange between India and the outside world. This is increasingly important as the tale of India's trade mounts steadily upward.

"As the world's output of gold is just now at a standstill, an increasing demand for India, such as we indicate, would dip deeply into the world's stock."

Correspondence and Discussion

Sampling Placer Ground

In the JOURNAL of March 25, appeared an article on sampling placer ground, in which it is advocated that pits should be used in sampling placer ground, but the limit as to the depth is placed at 15 ft. Two methods for determining the value of the ground are also given.

Why the limit of a test pit should be placed at 15 ft. I am not able to fathom. The depth to which a pit can be successfully sunk depends altogether on the amount of water encountered and to some extent on the looseness of the material to be handled. I have encountered ground carrying but a small amount of water in which no difficulty was experienced in sinking test pits to a depth of 50 ft. and more. But, even should the ground carry an excess of water, if the pit has been sunk to a depth of 15 ft., there is no apparent reason why the depth should not be continued to the limit of efficiency of the pump in use.

The first method given for the determination of the gold by means of pan samples, and "blowing" to eliminate black sand, cannot be considered accurate. Determinations made in such a manner are more or less a matter of guesswork. Whenever practical it is advisable that the total volume of material taken from the pit, be washed by the common sluice method. The concentrates from the sluice should be panned and the gold extracted from the sand by means of mercury. If sufficient water is not available then the rocker should be used, but in either case, in order to secure correct results it is advisable that all excavated material be washed.

A record of occurrence of the gold in the pit can be obtained by taking a pan of material out of each of the four corners for each foot in depth as the pit progresses. A memorandum is made of the number and size of the colors to each pan, as well as the depth at which they were secured; all of the gold thus secured is mixed with the amount yielded by the washing of the excavated material and the value accordingly computed.

The method of extracting the gold from the sand by means of blowing is used only in cases where the gold to be treated will not readily amalgamate, due to the presence of some foreign substance. However, such instances are rare, and for general treatment of concentrates from placers, the most preferable, and the one almost universally used, is to extract the gold from the sand, by the use of a small amount of mercury, afterward dissolving the mercury by nitric acid.

Views, Suggestions and Experiences of Readers

The second method of determining the value of placer ground by collecting samples from all pits, mixing them thoroughly, and taking a pan of this as an average, cannot be too thoroughly condemned. In testing a placer property it is of prime importance to determine the extent of the pay channel, location and proportionate decrease of the gold as distance from source increases, together with available area and value. How to attempt to do this by making one grab into such a mixture is a puzzle for the Chinese to solve.

ROBERT F. LAFFERTY.

Leadville, Colo., April 15, 1911.

Mine Disasters

It would seem that the two disasters commented upon in the JOURNAL of April 15 were both extremely fatal only because of dangers of underground fires.

Suppose, however, that in each instance the management had realized at once the extreme danger; would it have been possible to have notified the men of this danger in time?

The following conditions are characteristic of most American mines:

(1) No possible means of reaching all of the miners while at work except by messengers. In the case of slope mines with long side entries there is no signal nor telephone connection, except at the mouth of each entry. This would mean that the messenger must travel possibly one or two miles in toward the face before he could warn the men. In the case of shaft mines he would start from the bottom of the shaft and be compelled to travel the entire length of the longest entry.

(2) No thought has ever been given to the possibility of a mine fire, despite the fact that there may be long stretches of timbered haulageways, underground timber yards and engine rooms with timber supports resting on heart-pine, engine-foundation timbers that are oil soaked to a point of saturation. No fire drill of any kind has ever been discussed and the only intelligible fire alarm would be the word "fire."

(3) No one in charge who would feel qualified in calling the men out in case of a fire until the nature and extent of the fire had been investigated.

(4) The absolute necessity of having telephone or other signal connection with the face of each entry seems never to have received serious consideration.

Just so long as such conditions are the rule, instead of the exception, mine fires will prove as fatal as gas and dust explosions.

H. S. GEISMER.

Chattanooga, Tenn., April 16, 1911.

Geology Applied to Mining

Messrs. Linforth and Milburn gave, in the JOURNAL of April 1, an interesting and illuminating article on applied geology, in describing the methods and results of the work done by the Anaconda Copper Mining Company's geological department; this might well be supplemented by an account of the development of that department.

The imperative necessity for such a department as an aid to economic mining was clearly and concisely stated[1] by J. D. Kendall as follows: "It may be said the geological features bearing upon the development of a mine are, and must of necessity be, often studied by the management, although the observations are not recorded on any plans. Such a statement, it is submitted, amounts practically to saying that such studies are of the most perfunctory character; for it is impossible that any human being can produce a true mental picture of all rock changes, faults, dips, bearings and distances, that occur in a complicated mine, so that all the relations and correlations of important features may be studied. But even, if this were possible, a further difficulty remains; it is impossible to lay on that mental picture a protractor and scale, by the help of which a competent person may, from a consideration of facts of observation, properly recorded on an accurate drawing, arrive at facts of inference which will be of the greatest value to him in the future working of his property; they disappear with the man who made them, and are useless to those who follow in the management; whereas, observations carefully recorded, on properly prepared drawings, remain for the use of whomsoever they may concern. Furthermore, we all know that observations that have to be recorded are much more likely to be accurately made than those which it is not intended to commit to paper."

It was the appreciation of the truth in such statements and the importance of

[1] *Mining Reporter*, Vol. XLVIII.

geological study of mines which convinced H. V. Winchell of the necessity for a systematized record of his own and the notes of the many mining engineers, who had given a great deal of time to observations in connection with the apex litigation occasioned by the complicated structural geology of the Butte district. It was at that time—in the year 1900—that Mr. Winchell and D. W. Brunton formulated the plans and partially worked out the details for a geological department. Such a department was formed and a staff engaged under Mr. Winchell's direction. The department had to prove its economic *raison d'etre* and the first necessity was a careful geological survey of all the accessible workings after the manner described in Linforth's and Milburn's article. I believe this was the first geological department organized by a mining company.

While the immediate results were, for the most part, negative in that a profit could not be figured in dollars and cents there were results, which would show a positive, though in some cases an intangible saving. I recall an instance where the mining department had made plans for a large underground pumping station. These plans were approved by the engineers, but it remained for the geological department to point out the fact that if such a station were cut, it would be crossed by an extensive fault, there would be more or less movement along this fault to the detriment of concrete foundations, and there would be a constant drip of water and ooze of soft wet clay to contend with. The plans were changed and these difficulties were avoided.

In addition to the necessity of demonstrating its usefulness to the management, the department had to overcome the prejudice of the mine foremen and bosses. The geological notes of the older parts of the mines were necessarily incomplete and would have to be supplemented by information known only to foremen and bosses. However, these men were usually fair minded and a few manifestations of the ability of the department to save them time and expense in their development work served to establish an understanding which has continued, until now the department and the mine bosses work in harmony.

Then, too, there was the suspicion of the engineering department, that their prerogatives would be infringed on, which had to be overcome. In a surprisingly short time the department proved its usefulness and the staff under the chief geologist grew from two to seven technical graduates engaged in carrying on the work recently outlined in the article —"Geology Applied to Mining." There is another sphere of usefulness for the mining geologist, in the employ of a mining company, which has been suggested by this article. Often new mining ventures are submitted to a mine manager. He seldom has the time to investigate them himself, but with a mining geologist on his staff, he can acquire all the facts regarding the proposed scheme at only slight cost to his company. Mining companies, be they ever so prosperous, are bound to be confronted at times by propositions for acquiring new properties. The scope of the department's work could be extended, under the direction of the chief geologist, to cover such exploration at no prohibitive additional cost and a fund of information would be gained which, if it did not lead directly to the acquisition of new and valuable properties, would render unecessary an examination, by a high-priced engineer, of territory, perhaps, already reported on by the geological department.

There is another field for the geological department which, as yet, has been only partially covered: the transcontinental railroads and some steamship lines. At present the railroads are in the habit of sending a geologist or other engineer to investigate a circumscribed area, a report is made, read, and put away in some almost inaccessible file.

The specific purpose of that specific report has been accomplished but, the bearing it may have on adjacent territory is forgotten and the report falls short of fulfilling its possibilities. Instead of this method of procedure, the information in these reports should be classified and recorded in a systematic manner. Maps of a convenient size should be made covering the territory and when assembled, would make a complete geologic map.

Aside from information of a purely geologic character, these maps could, in conjunction with a proper filing system, be arranged so that they would show the agricultural and other possibilities of any area as well as the mining. The limit of usefulness for the geological department has not been reached, and I hope to see more articles describing methods and results akin to those outlined by Linforth and Milburn.

FRED. T. GREENE.

Butte, Mont., April 15, 1911.

In his letter in the JOURNAL of April 8, "Field Engineer" remarks, "the field engineer would be yet more indebted to the geologists if they would provide him with a simple group of family names for the igneous rocks; names that he may employ with a sense of security and assign to any rock without resorting to the microscope and thin sections, etc."

Surely the simple classification given by Louis V. Pirsson in his excellent book, Rocks and Rock Minerals, should fill the bill, for, in this system, microscopical distinctions play no part. For instance, if the engineer is not sure whether a fine-grained volcanic rock is rhyolite or dacite he classifies it as "felsite" and lets it go at that. If such a rock be dark in color it is styled "basalt" and so on. When a granular igneous rock is chiefly made up of feldspar and hornblende it is called a "diorite," if the amount of hornblende equals or exceeds the amount of feldspar. A granular igneous rock mainly composed of feldspar and pyroxene is likewise, in this classification, termed a "gabbro," when the amount of pyroxene equals or exceeds the amount of feldspar, while if, owing to fineness of grain or other causes, the observer is not sure whether the dark mineral is pyroxene or hornblende, or a mixture of both, he gets over the difficulty by styling such rocks "dolerite." Evidently, therefore, "dolerite" is an exceedingly convenient field name, for it includes the finer-grained diorites and gabbros as well as many diabases.

"To every thing there is a season," and as the field is no place for the refinements of the laboratory nor for hair-splitting distinctions, the simple and eminently practical classification mentioned will doubtless, as it becomes better known, in the words of common advertisements "supply a long-felt want."

GORDON SURR.

San Bernardino, Cal., April 13, 1911.

Seeking Employment

I should like to express my agreement with the statements made by Mr. Herdy in the JOURNAL of April 1 and add all possible emphasis to the suggestion that the question of obtaining employment be taken up by the American Institute of Mining Engineers.

In the meantime, as Mr. Lamb has suggested it to me and as I am more likely to be found "at home" than anyone engaged in technical work, I am willing to do what I can toward carrying on the work commenced by Mr. Lamb until it can be taken up by some such organization as the Institute. I should like to hear from those interested in any way whatsoever. RAYMOND C. BENNER.

University of Arizona, Tucson, Ariz.

Arizona Copper Belt Mining Company

The Arizona Copper Belt Mining Company, of Wickenburg, Ariz., has published a prospectus containing what purports to be a letter by me, over my signature. This is a wholly unauthorized letter. I have never been in Arizona, much less examined any properties there.

I have demanded of the president of the Arizona Copper Belt Mining Company that the alleged letter be withdrawn. I request that the JOURNAL will publish this communication in order to help correct any erroneous impressions that the letter may have given.

R. W. GROO.

Bingham Cañon, Utah, Apr. 13, 1911.

Details of Practical Mining

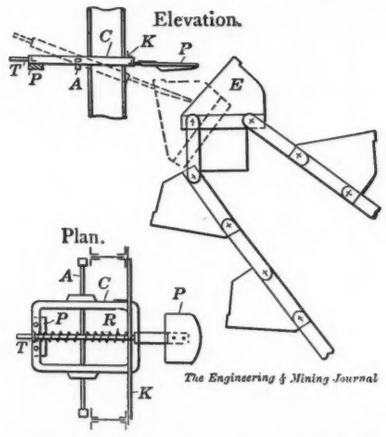
This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent of telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of a pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

Notes of Interest to Prospectors and Operators of Small as well as Large Mines Things that have to be done in Everyday Mining

Device to Empty Dredge Buckets

BY LÉON DELVAUX*

The overburden which covers the pay streak in the alluvial deposits of French Guiana is frequently clayey and sticky and the buckets become clogged and do not discharge when revolving round the top tumbler: the same load thus goes round and round, and the output is practically reduced to nothing. In such cases



DEVICE TO EMPTY GOLD-DREDGE BUCKETS

it was sometimes found necessary to stop the bucket chain, even several times an hour, and have men with hand shovels clear the buckets. I designed a device to obviate this trouble and fitted it in March, 1909, on the dredge operated by the Syndicat Mana on the Orion placer; it has been in continuous operation since that time, and in some instances has increased the output by fully 50 per cent.

It consists of a steel shovel *P*, riveted on a stem *T* which is carried on a frame *C*, through which it can slide. The frame *C* is mounted on an axle *A*, held in two bearings which are attached on the vertical girders of the main framing. An adjustable cross bar *K* is also attached on the girders and makes the stop for the oscillation of the shovel. The frame is fitted with a weight *P*, which counterbalances the shovel. The shovel being in the horizontal position shown on the sketch enters the bucket *E*, near the lip; the shovel forces its way through the material which fills the bucket, and is driven downward (as shown in dotted lines) by the motion of the bucket chain, thus clearing the bucket. As soon as the forward end of the shovel is clear of the bucket lip, it is brought again in the original position, ready for the following bucket. Although this return could be theoretically effected through the balance weight alone, it has been found useful in practice to keep one man on watch and to help the shovel frame on the return stroke. The device being only necessary when the dredge is working on the sterile overburden, the men have then no work to do on the gold tables and one of them is sent to the top-tumbler device. If a boulder comes up in one of the buckets, the shovel recedes, the stem sliding back through the frame, and is brought again in position through the coil spring *R*. The device is, of course, only suitable for open-connected buckets.

*Mining engineer, 62, rue Taitbout, Paris.

Making Copper Shot

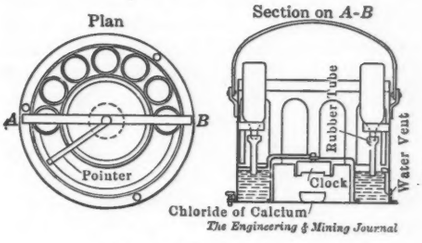
A correspondent wishes to know whether it is possible to pour copper directly from the launder of a copper-refining furnace into water to make hollow shot?

It is usually thought that to produce hollow shot it is necessary to break up the stream of copper with a stream of air or steam before it is struck by the stream of water. It is also essential to have a small amount of sulphur in the copper in order to produce the best hollow shot. If the shot are to be used in making bluestone it is desirable to have as little impurity present as possible, owing to the slime formed clogging up the dissolving towers and retarding the operation, consequently it is usual to refine the copper in the customary way, by oxidation followed by poling, after which the copper is "thrown back" by the addition of about 1½ per cent. of a pure "white metal."

Automatic Mine Air Sampler

In the course of an extended series of tests made by L. Morin at Liévin to determine the relation between barometric pressure and the escape of firedamp, it was found advisable to take the samples of mine air automatically and at definite intervals. A device constructed for this purpose is described by P. Petit, of the Saint-Etienne collieries (*Bull.* de la Société de l'Industrie Minérale, Jan., 1911.) In principle, the air samples are secured by emptying a bottle of water at the place at which the sample is desired.

As shown in the figure, 12 bottles of 250 c.c. capacity are held in an inverted



MINE AIR SAMPLER

position in a circular rack; a short length of rubber tube attached to the neck of each bottle dips about one centimeter under the surface of the water in the bottom of the apparatus. In a closed receptacle in the center of the machine is a clock, the hour hand of which is long enough to reach out and push aside the bottom ends of the rubber tubes to a sufficient distance to allow the water in the bottle to escape and be replaced by air. As soon as the pointer releases the rubber tube, the latter resumes its position under water and thus seals off the sample of air. An opening in the side of the basin maintains the water at a constant level. Before removing the sample bottles, the rubber tubes are clamped with pinch cocks. The tubes must be of large enough size, about 10 mm. inside, to allow free interchange of water and air. Ordinarily more time elapses while the end of the tube is out of water than is actually necessary for the emptying process, but little or no error seems to be introduced by this fact. In an airway through which air is passing at a considerable velocity, the composition of the atmosphere is nearly identical at every point in the sectional area, but in rooms, and in headings in which circulation is deficient, it is difficult to secure a fair

sample without employing some artificial means for stirring up the air in the vicinity of the sampling apparatus.

Candle Tests

By Claude T. Rice

Candle tests are run frequently at many mines, but generally candles of the same make are tried—the Granite candle, a soft one, against the hard wax candles, the Goodwin or the Schneider. There are several factors affecting the life of a candle, the most important being the condition of the air; air currents, poor ventilation, and hot workings cause candles to burn dimly and unevenly, so all the material is not consumed. The size of the candle has an important bearing upon the cost per man, and often a cent per man can be saved by changing the weight.

The accompanying table, made from the results of a test at a fairly well ventilated mine of about the average temperature for a deep mine, is interesting as showing the merits of some new candles or rather candles that are not so well known to western miners, while it also brings out the importance of the weight of the candle used. It may be added that the cost of candles has been brought down at this mine since the tests were made to 3.203c. per man, using 12-oz. "Sunlight" candles.

CANDLE TESTS.

Make of candle	Standard Oil "Granite"	Perry (hard wax)	Perry (hard wax)	Perry (hard wax)	Werks (hard wax)	Schneiders (hard wax)	Goodwins (hard wax)	Standard Oil, No. 1 Hard	Sunlight (Soft candle)	Sunlight	Sunlight
Weight, ounces	12	14	12	13	14	14	14	12	13	13	12
Length of test, days	31	15½	17	26	23	29	14	16	30	31	30
Number of men working per day	345½	306	322½	396¾	366	380	388¾	383¾	429½	375½	377½
Price per box at mine	$3.45	$4.64	$4.08	$4.36	$5.057	$4.956	$5.15	$4.35	$2.93	$2.93	$2.75
Candles used per man per day	4.35	3.06	3.94	3.58	3.30	3.7	3.5	3.7	3.44	3.546	3.538
Cost per man per day	$0.062	$0.071	$0.067	$0.065	$0.0697	$0.0778	$0.749	$0.064	$0.0421	$0.0433	$0.0403

Deterioration of Wire Ropes

The deterioration of mine ropes due to absorbed hydrogen has lately been discussed before the Transvaal Institute of Mechanical Engineers. W. A. Caldecott regards the absorption of hydrogen, generated by contact between the wire rope and acid mine water, as being a potent and dangerous cause of weakened ropes. Specimen wires were taken by him from an unused rope, of which some were tested without acid treatment, and some after being immersed in a solution containing 0.03 to 0.04 per cent. H_2SO_4. The test wires were 0.101 in. in diameter, and 31.5 turns were required to break a 8-in. length of the untreated wire. After 14 hours immersion in the above solution an average of only 12 turns were required to break the 8-in. test piece, while after 15 hours immersion only 9 turns. The wires showed hardly any corrosion and the tensile strength was but little affected.

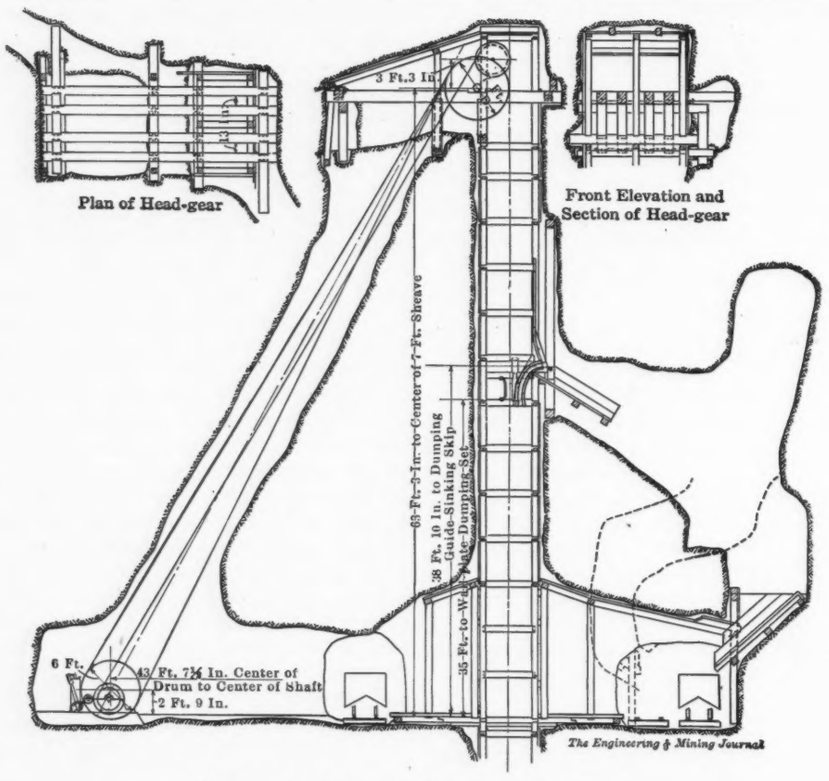
In another experiment, using a bath of mine water containing: H_2SO_4, 0.0086 per cent.; $FeSO_4$, 0.018 per cent.; $Fe_2(SO_4)_3$, 0.022 per cent., the number of turns required to break 5-in. test pieces was reduced by a 24-hr. immersion from 21.6 bends to 9.8 bends. To a great extent the strength of the wire is restored by boiling for three hours, the hydrogen being expelled by the heating. Any method of heating a mine rope would restore its strength, the use of an electric current being suggested. Of course the temperature cannot be allowed to go high enough to injure the hemp core. The use of an acid-free preservative on mine ropes from the beginning is recommended, and the existence of this field for further study is pointed out.

Wood saws made of vanadium steel—C, 0.80 per cent.; Mn, 0.45 per cent.; chromium, 1.0 per cent.; and V, 0.25 per cent—can, according to the *Iron and Coal Trades Review*, cut through mild-steel bars without damage to their teeth, and have sufficient ductility to permit the nose being bent through the handle.

An Underground Hoist

The accompanying illustration shows the method of arranging the hoisting equipment for a large winze that was sunk by N. T. Tregear for the Black Mountain Mining Company, operating a copper mine near Magdalena, Sonora.

The winze was sunk to a depth of 400 ft. from the No. 8 tunnel at a distance of 1200 ft. from the portal. Below the collar there are two compartments, each 4½x5 ft. in the clear, while above the collar there are two compartments, each 4½x5 ft., that were carried up to support the sheaves and to obtain head room above the tunnel for an automatic dumping skip and two ore pockets.


Plan of Head-gear
Front Elevation and Section of Head-gear
3 Ft.3 In.
63 Ft. 3 In. to Center of 7-Ft. Sheave
38 Ft. 10 In. to Dumping Guide-Sinking Skip
35 Ft.-to-Wall Plate-Dumping Set
6 Ft.
43 Ft. 7½ In. Center of Drum to Center of Shaft
2 Ft. 9 In.
The Engineering & Mining Journal

Arrangement of an Underground Hoist

The sheave-wheel bearers are dressed timber 11½x15 in. and 26 ft. long; the bearing posts are 12x12 in. section, as are also the supporting bearers and dividers. The housing is made of 8x8-in. timber; the shaft sets are 8x8 in., and the auxiliary dumping set is of 7½x11½-in. timber; two of the collar bearers are 12x12 in., and two 8x8 in., and the guides are 5½x5½ in. section. The shaft sets

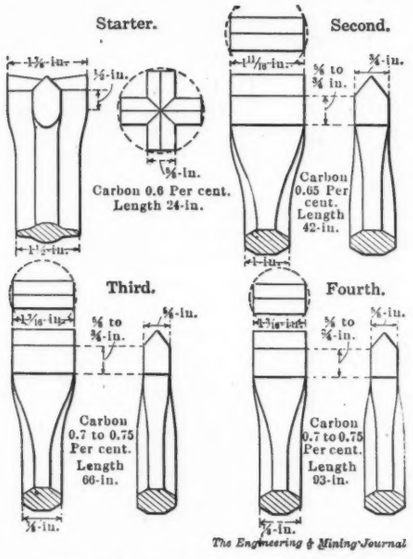
are spaced 5-ft. centers, the station sets 15 ft. and the dumping set 20 ft. The winze is lagged with 2-in. lumber.

The upper 300 ft. above water level was sunk at the rate of 85 ft. per month, by Mexican laborers using air drills, at a cost of 17.50 pesos per foot.

Rand Drill Steel and Bits

By E. M. Weston

Tests have recently been made by Robert Allen at the Robinson Deep mine to determine the most suitable steel for making drills for use in the Rand mines. Many varieties of steel have been tested in the following way. From 40 to 60 drills made from each brand of steel were sharpened by hand, weighed, measured by a micrometer gage, then sent to the mine where they were used in 2¾-in. machines to drill the hardest rock. The depth of holes drilled and time taken were noted. The drills were then sent to the surface where they were again


Starter.
Second.
Third.
Fourth.
Carbon 0.6 Per cent. Length 24-in.
Carbon 0.65 Per cent. Length 42-in.
Carbon 0.7 to 0.75 Per cent. Length 66-in.
Carbon 0.7 to 0.75 Per cent. Length 93-in.
The Engineering & Mining Journal

Drill Bits Used on the Rand

weighed and measured and the quality of the steel compared by the loss in gage.

It is difficult to convince the Rand miners that the proper heating and tempering of the steel has an important bearing on the efficiency of the drills, so it was necessary to recommend steel of such carbon content as would permit of direct plunging in the type of tank giving a limited depth of immersion for cross bits.

The bits, as finally adopted are shown in the accompanying illustration. They are used in 2½ and 2¾-in. machines. The starting bit is used to drill 15 in. of hole, the second 21 in., and the third and fourth 24 in. each.

With higher air pressure I believe that the third and fourth bits should be made of 1-in. steel, as even with 70 lb. air pressure a 2¾-in. machine will bend some of the ⅞-in. drills. From 0.7 to 0.75 per cent. carbon is the highest that will permit of steel being satisfactorily welded and which will temper without cracking on direct plunging.

A Dry Concentrator for Placer Gold*

By J. V. Richards†

At Las Palomas, Sonora, Mexico, a dry concentrator or air-blast machine working by virtue of the difference in density of metal and gangue is used to recover gold from the disintegrated binding material of cemented gravel.

The dry washer consists of a small table about 4 ft. long by 2 ft. wide with a cloth top and a bellows below. The gravel is fed, through a hopper, at one end. The top of the table consists of a fine wire netting like ordinary fly screen. On this is placed one and sometimes two layers of burlap, and over this a layer of thin cotton cloth; old flour-sacks are often used. Four ½-in. riffles are fastened at equal intervals across the surface. Detachable wooden sides are used to keep the gravel from spilling over. The machine is usually built to stand level, but is set on the edge of a dump at an angle of about 20 deg. from the horizontal. It is kept carefully leveled in cross-section.

A hand-crank belted to a small drive wheel operates the bellows, which has the ordinary clap valves in the bottom and canvas sides. The intermittent puffs of air from this bellows, coming through the cloth top at the rate of about 150 per min., cause the sand and gravel to jump the riffles and travel down the table and over the end. Most of the gold, together with a considerable amount of black sand, is caught behind the first two riffles. The capacity of such a machine is from 2 to 2½ cu.yd. per hour.

After several yards of gravel have been passed over the table, the machine is stopped, the side boards removed and the material behind the riffles brushed into a gold pan. It is then fed back slowly, nearly all the gold this time remaining behind the first riffle. The first and second riffles are then brushed out clean and the resulting sand, black sand and gold is "tossed" in a batea and the gold separated dry and clean.

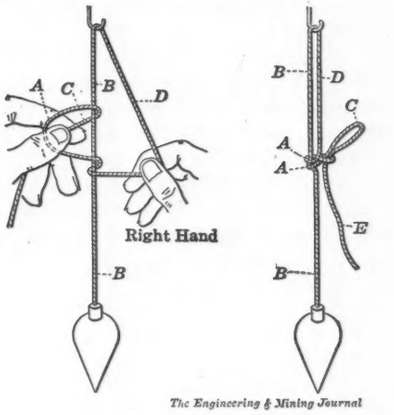
For the successful operation of the dry concentrator, it is essential that the sand be absolutely dry. Even a small amount of dampness tends to clog the cloth and the riffles. In the case of a cement gravel it is also, of course, necessary that the material fed to the machine be thoroughly pulverized. Hand pulverizing being exceedingly tedious, several disintegrating machines have been devised for this work. Most of these machines are faulty in the respect that they not only pulverize the cement but smash up the pebbles as well, which is obviously useless labor as all that is required is to clean and eliminate the gravel and pulverize the cement. The machine known as the Quennor disintegrator (named after the inventor) does this work more or less successfully. This machine consists of a cylinder 7 ft. long and 4 ft. diameter, made up of 1½-in. steel strips with slits about ⅛ in. between them. In the center is a shaft, to which are attached short chains having tough, heavy manganese-steel lugs, the size of a fist, at the free ends. The cylinder revolves in one direction at about 40 r.p.m., while the center shaft revolves in the opposite direction at four or five times this speed. The cement gravel, fed in through the hopper, is thoroughly broken up by the action of the chains and lugs, the fine material dropping out through the slits, and the coarse pebbles being ejected through the end of the cylinder.

*Abstracted from an article in *Bull.*, A. I. M. E., April, 1911.

†Mining engineer, Empire State building, Spokane, Wash.

A Plumb Bob Knot

The slip knot shown in the accompanying illustration for tying the plumb bob to the transit is used by some of the



Plumb Bob Knot

surveyors in the anthracite region of eastern Pennsylvania, says the *Eng. News* for March 2, 1911. It is particularly useful in that district because of the large amount of underground surveying where the plumb bob is hung above the transit. The common slip knot will occasionally slip when not desired, letting the bob fall upon the transit, which usually results in breaking the glass of the compass box. If the ordinary slip knot is tied tight enough to insure safety there is a difficulty in slipping the knot to adjust the length of string.

The knot shown overcomes this difficulty, and requires no longer to tie than the common slip knot. Hold *A* with the thumb until *C* is pushed through it with the forefinger. Now let loose of *D* with the right hand and with it pull *C* on through loop *A*, which gives the final knot. Pulling *E* unties the knot.

Cost of Fuels for Forges

At the properties of the Mammoth Copper Mining Company in California, tests have been made with various fuels for use in forges at both the smeltery and mine blacksmith shops. Coke, coal and oil were tried. At the smeltery it was found that the oil was cheapest, while, at the mine, oil was found to be cheaper than either coke or coal in the forge used for heating steel for the drill sharpener, and coal was cheaper than either coke or oil in the blacksmith forge.

FUEL COST FOR MINE FORGE AT KENNETT, CAL.

	Coal	Oil
Number of shifts	75	28
Forges running per shift	4	2
Amount of fuel used	9.239 tons	992 gal.
Fuel used per shift	246.3 lb.	35.4 gal.
Fuel per shift per forge	61.6 lb.	17.7 gal.
Cost of fuel	$179.236	$28.768
Freight to mine	30.19	15.475
Charges for loading oil	.....	4.444
Total cost of fuel at mine	$209.355	$48.687
Cost of fuel per shift	$2.791	$1.738
Cost of fuel per shift per forge	0.691	0.867
Extra charges for oil:		
Cost of bricks		$5.40
Cost of labor		5.01
		$10.41
Cost of repairs per shift		$0.371
Cost of repairs per forge per shift		0.185
Total cost per shift per forge		$1.052

The oil heats steel and iron quickly, but an undesirable feature is the roaring noise caused by the compressed air used to atomize the oil. For general blacksmithing, such as bending, the oil gives too large a flame, but when a large area is to be heated it is superior to other fuel. Most smeltery work requires a flame heating a large area, while the converse is true for most mine blacksmith work. Moreover, at the smeltery, as there is considerable work to be done, there are usually several forges in use and the number of forges that are kept running is adjusted to the amount of work, so that a forge is kept in operation as continuously as possible. This makes the wear and tear on the oil-fired forge at the smeltery much less than on a similar forge at the mine, as at the mine there is generally not enough work to keep one forge going all the time. The consequent alternate cooling and heating plays havoc with the firebricks in the bed of the forge. This is the main expense in the maintenance of an oil-fired forge.

FUEL COSTS OF HEATING DRILLS FOR SHARPENER AT KENNETT, CAL.

	Coke	Oil
Number of nine-hour shifts	235	58
Amount of fuel	44,795 lb.	550 gal.
Amount of fuel used per shift	190 lb.	9.5 gal.
Drills sharpened per shift	429	312
Cost of fuel, Kennett	$273.72	$15.95
Cost loading fuel	$11.20	$0.833
Haulage to mine	$10.08	$1.13
Total cost of fuel at mine	$295	$17.91
Total cost of fuel per shift	$1.2555	$0.3088
Total cost of fuel per shift per drill	$0.0029	$0.00098
Amount of fuel used per drill sharpened	0.444 lb.	0 0304 gal.
Amount saved per day of two nine-hour shifts, sharpening steel with Word sharpener by using oil instead of coke		$1.88

At the smeltery blacksmith shop the use of oil has resulted in a saving of a third of the labor required to do the blacksmithing as compared with coal-fired forges, while the oil is also much cheaper. Accompanying tables give the results of tests of the two fuels best adapted to the work in hand, which were made at the Mammoth mines.

The test to determine the fuel cost for heating steel for the drill sharpener indicates that coke is better than coal; oil better than coke. The cost per drill heated with oil was 0.098c. and with coke 0.29c., a saving of 0.192c. For the mine forge, oil proved more expensive than good blacksmith coal, and the maintenance of the forges was much greater when oil was used.

The cost of the coal per forge per shift, with coal at $22.69 per ton, delivered at the mine, was 69.1c., and for oil at 4.9c. per gal. at the mine, it is 86.7c. for fuel alone, while the repairs averaged 18.5c. per forge per shift, making the total cost of oil firing $1.05 per forge per shift. The saving per forge per shift with coal was 36 cents.

There can be no question that in such work as sharpening steel, where an even temperature is essential to good work and the work is fairly continuous over periods of a few hours, oil is not only the cheapest but also the best fuel to use in bringing the steel to forging temperature.

Homemade Bricks

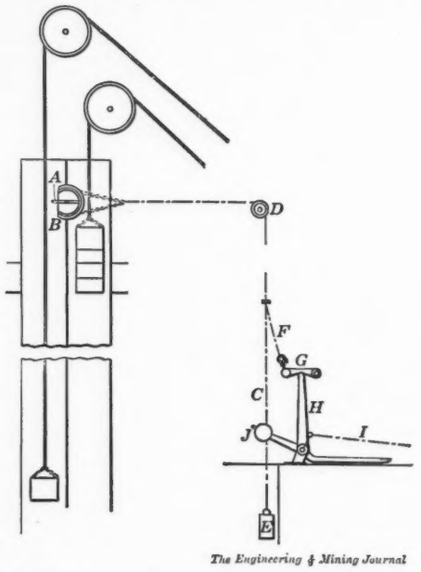
In remote districts, ordinary building materials are often lacking. Where labor is cheap it is frequently possible to secure a fairly serviceable homemade brick when a suitable clay deposit can be found in the neighborhood. Excellent bricks can be made even by inexperienced men.

Puddle the clay well, but do not add enough water to make it so plastic that it loses its shape when left unsupported. The molded bricks should be allowed to dry slowly in the sun. For burning, dig a pit 6 ft. square and 6 ft. deep. Heat the bottom and sides by a dry brush-wood fire, stack the bricks leaving spaces between them, and fire at the top with a brisk brush-wood fire for 30 to 48 hours, according to the time found necessary by trials. The bricks so burned will include a smaller percentage of "white washed" and "hard burnt" bricks than is usually obtained in kilns. Three men, a puddler, a molder and a stacker should mold 500 bricks in eight hours, when bricks are made by hand.

To test clay for brick making, puddle it well with a little water, let it dry slowly in a shady place, then burn in a forge. If the brick shrinks or cracks badly, fine sand should be added to the clay to temper the mixture.

Device for Prevention of Overwinding

The device shown in the accompanying illustration is installed at a German shaft to prevent overwinding. At a point about 30 cm. above the highest normal position of the cage is pivoted an axle, carrying at its center a lever *A*, which projects out into both hoisting compartments, and at its end the pulley *B*, to which a length of chain is attached at two points, as shown. The middle point of this chain is connected to a wire rope which, after passing over the pulley *D* hangs down a suitable distance and is kept taut by the weight *E*. A short piece of rope *F* connects the first rope with an end of the latch *G*, which engages the top of the lever *H*. The rope *I* attached to *H*, leads to the throttle valve of the engine, and also to the valve of a steam-actuated brake.



DEVICE TO PREVENT OVERWINDING

A slight upward pressure against either end of the lever *A* thus lifts the latch *G*, allowing the weight *J* to act through the rope *I* on the engine. The same effect could be produced electrically, though possibly not with equal certainty, by establishing contact through the guide shoes of the cage, and providing a magnetic release for the latch *G*.

About 99 per cent. of all mine labor at the Broken Hill South Silver Mining Company, New South Wales, is done under contract. The men under these conditions average from $2.53 per day for the muckers to $3.86 per day for miners on development work.

Spelter Statistics for 1910

By W. R. Ingalls

A summary of the production of zinc ore and spelter in the United States in 1910, together with estimates of the consumption of spelter and a statement of the zinc-smelting capacity.

The production of spelter in the United States in 1909 and 1910 is given in Table I, which as to the ore smelters is compiled from reports officially communicated by every one. As to the dross and scrap smelters the production of three small concerns has been estimated. Under the classification of "dross and scrap" smelters I include only those concerns that work up such material and market the product as spelter. Some of them redistil and some of them simply remelt, skimming off impurities. Their business does not differ essentially from that of the smelters who make spelter out of ore, and indeed a good many of the latter treat dross in connection with ore. Besides this reclamation of zinc from by-products, junk, etc., many consumers of spelter reproduce spelter from their own waste. It is extremely difficult to enumerate accurately the amount of such recovery, and I have not attempted it. Nor would such an enumeration properly play a part in statistics of the spelter industry.

I. PRODUCTION OF ZINC

By Ore Smelters

States	1909	1910
Colorado	6,115	6,564
Illinois	75,229	79,570
Kansas and Missouri	111,808	112,182
Oklahoma	28,840	34,760
East	44,470	43,989
Totals	266,462	277,065

By Dross and Scrap Smelters

1909	1910
15,997	11,350

Total Production of Zinc

	1909	1910
Ore smelters	266,462	277,065
Dross smelters	15,997	11,350
Totals	282,459	288,415

II. PRODUCTION OF ZINC ORE

State	1909*a*	1910*b*
Arizona	7,908	7,568
Arkansas	320	190
Colorado	90,288	77,065
Idaho	2,784	10,248
Kentucky	94	179
Missouri-Kansas	304,581	289,913
Montana	12,037	33,514
Nevada	4,609	4,915
New Mexico	19,163	15,959
New Jersey	479,699	*c*
Oklahoma	17,089	1,640
Tennessee	1,710	2,775
Utah	18,130	27,318
Wisconsin	69,000	51,383
Others	572	46,905
Totals	1,027,984	569,572
Mexico	90,707	29,198
Canada	9,163	11,795

a Production. *b* Smelters' receipts; reports missing from three small smelters. *c* Included in "Others."

The ore smelters reported a production of 7793 tons of spelter from dross in 1910, and 269,272 tons from ore.

In 1910 there were produced 3398 tons of spelter in bond, most of which had been exported before the end of the year.

All of the ore smelters except two small concerns, whose output of spelter was 6170 tons, reported the amount and sources of their ore receipts, which enables the compilation of Table II.

The statistics for 1909 and 1910 in Table II are not properly comparable, without explanation. Those for 1909 represent the total receipts of zinc ore, both by spelter and oxide manufacturers, except that the figure for New Jersey represents the mine production. The figures for 1910 represent the receipts of ore by spelter manufacturers only, with the exceptions previously noted. The concentrates produced from New Jersey ore are included for the total entered under "Other States."

It seems probable that some of the smelters in reporting credited to Missouri and Kansas some ore that came from Oklahoma. The shipments from the Joplin district in 1910 were about 291,000 tons, of which about 15,000 came from Oklahoma. The shipments from Wisconsin mines in 1910 were 62,000 tons, this including what went to oxide works.

The amount of zinc ore reported by the smelters as received from Canada and Mexico in 1910 was 40,993 tons. The imports reported by the Government were 83,057 tons. Foreign ore containing 4712 tons of zinc was reëxported, which probably corresponded to about 12,000 tons of ore. Of the imports reported, 11,683 tons were received by the lead smelters. Allowing for changes in the quantity of ore remaining in bond there probably is no irreconcilable discrepancy between the Government figures and those of the smelters.

In 1910, sulphuric acid was made as a byproduct by seven zinc smelters, their aggregate output having been about 202,000 tons, basis, 60 deg. B. These smelters produced 100,791 tons of spelter. They received 49,328 tons of blende ore from Wisconsin, and 102,466 tons from the Joplin district, besides less supplies from the Rocky mountains. It is noteworthy that these works buy nearly the whole output of blende in Wisconsin and about one-third of the total production of zinc ore in the Joplin district.

Consumption

All of the ore-smelters except Chanute and Sandoval reported their stock on hand at the end of 1910. Including a small estimate for these, the total was 23,000 tons. Disregarding any stock that may have been in the hands of dross and scrap smelters the deliveries into consumption in 1909 and 1910 are computed in Table III.

III. DELIVERIES INTO CONSUMPTION

	1909	1910
Stock Jan. 1	25,000	11,500
Production	282,459	288,415
Imports	9,670	3,452
	317,129	303,367
Exports, domestic	2,566	3,989
Exports, foreign	334	4,468
Stock, Dec. 31	11,500	23,000
Deliveries	302,729	271,892

In addition to the spelter produced in bond and exported in slabs, 4486 tons of foreign spelter was exported in 1910 under drawback privilege. This does not, however, enter properly into a computation of domestic consumption, its application in the manufacture of wares in this country having been a consumption.

As to actual consumption I cannot speak with confidence. Reports from consumers other than brass-makers, accounting for 170,982 tons of spelter, show in their cases about the same consumption as in 1909. In galvanizing there was a trifling increase; in the rolling of sheet zinc a small decrease. Reports received from brass-makers are too incomplete to furnish statistical indication of the position of that industry, but judging from the consumption of copper in 1910 there was probably an increased manufacture of brass.

The consumption of spelter in the United States in 1909 was estimated at 261,600 tons. In 1910 it was probably in the neighborhood of 270,000 tons, divided approximately in the ratio of 60 per cent. for galvanizing, 20 per cent. for brass-making, 11 per cent. for sheet zinc, and 9 per cent. for other purposes.

Smelting Capacity

The capacity of American zinc works at the end of 1910 is given in Table IV, the number of retorts having been reported officially by all of the producers except Chanute and Sandoval.

Of the total of 91,291 retorts, 10,528 are owned by smelters at Bartlesville, Okla., 22,737 at Iola, Kan., and 22,158 at other places in Kansas. The furnaces of the United States Zinc Company at Pueblo, Colo., have Rhenish retorts. At all of the others the retorts are of the Belgian type.

At the works of the Lanyon Zinc Company at Iola, Kan., the last furnace was closed down on Dec. 26. The three works will now remain closed indefinitely. The American Metal Company has surrendered its lease of them.

The United Zinc and Chemical Company dismantled its Iola plant. At its

Springfield plant it added one block of 800 retorts, and began building two blocks comprising 1600 retorts. The Mineral Point Zinc Company increased its plant at Depue by one block of 600 retorts. The Bartlesville Zinc Company added two blocks, comprising 1152 retorts.

Of the old coal smelteries, the Pittsburg Zinc Company closed its plant early in 1911, and the Cockerill plant at Nevada, Mo., also was closed. On the other hand the works at Collinsville, Ill., long idle, were put once more into operation. The Cockerill Zinc Company went out of business in 1910, its Altoona works being taken over by Beer, Sondheimer & Co., and its Laharpe and Gas City works by L. Vogelstein & Co., the other plants becoming idle.

At the end of 1910 plans were on foot for one new smeltery in the gasfield of Oklahoma, and for at least three plants in the coalfields of Illinois. Construction of some of these will go on in 1911. Since the beginning of 1911 the works of the Bertha Mineral Company at Pulaski, Va., have been closed, and also those of the New Jersey Zinc Company at Bethlehem, Penn. The Palmerton works are being enlarged to take the place of Bethlehem.

IV ZINC SMELTING CAPACITY OF THE UNITED STATES AT END OF 1910

Name	Location	Furnaces	Retorts
American Zinc, Lead and Smelting Co.	Deering, Kan.	6	3,840
American Zinc, Lead and Smelting Co.	Caney, Kan.	6	3,648
Bartlesville Zinc Co.	Bartlesville, Okla.	8	4,608
Bertha Mineral Co.	Pulaski, Va.	10	1,400
Chanute Zinc Co.	Chanute, Kan.	4	1,280
Cockerill Zinc Co. (Beer, Sondheimer & Co.)	Altoona, Kan.	6	3,840
Cockerill Zinc Co. (L. Vogelstein & Co.)*	Gas City, Kan.	4	2,560
Cockerill Zinc Co. (L. Vogelstein & Co.)	La Harpe, Kan.	3	1,853
Cockerill Zinc Co.*	Nevada, Mo.	3	648
Collinsville Zinc Co.	Collinsville, Ill.	6	1,536
Edgar Zinc Co.	St. Louis, Mo.	9	2,000
Edgar Zinc Co.	Cherryvale, Kan.	24	4,800
Granby Mining and Smelting Co.	Neodesha, Kan.	6	3,840
Grasselli Chemical Co.	Clarksburg, W. Va.	10	5,760
Hegeler Bros.	Danville, Ill.	2	1,800
Illinois Zinc Co.	Peru, Ill.	7	4,640
Lanyon-Starr Smelting Co.	Bartlesville, Okla.	5	2,880
Lanyon Zinc Co.*	Iola-La Harpe, Kan.	15	9,740
Matthiessen & Hegeler	Lasalle, Ill.	5	4,380
Mineral Point Zinc Co.	Depue, Ill.	6	4,520
National Zinc Co.	Bartlesville, Okla.	5	3,040
New Jersey Zinc Co.	Palmerton, Penn.	12	2,848
New Jersey Zinc Co.	Bethlehem, Penn.	19	1,680
Pittsburg Zinc Co.	Pittsburg, Kan.	4	910
Prime Western Spelter Co.	Gas, Kan.	14	8,584
Sandoval Zinc Co.	Sandoval, Ill.	4	896
United States Zinc Co.	Pueblo, Colo.	7	1,680
United Zinc and Chemical Co.	Springfield, Ill.	3	2,080
		213	91,291

*Inactive.

Asbestos in Russia

The asbestos production of Russia in 1910 is reported to have been 11,450 metric tons, derived as follows: Voznesensky mines, 5000; Govoruzhinsky mines, 2450; Shtsuivi mines, 3500; others, 500. These mines are situated on the eastern slope of the Urals. The lodes are very irregular. One ton of serpentine yields about 14 lb. of asbestos. Some of the asbestos is of excellent quality.

The Pancoast Inquest

SCRANTON CORRESPONDENCE

The inquest upon the death of the 73 men who lost their lives by the fire that broke out in an engine house at the China vein of the Pancoast mine at Throop, Penn., on the morning of April 7 was formally opened April 17 at the Scranton court house before Coroner John F. Saltry and a jury of one mining engineer, three miners and two citizens. The investigation was continued on April 21 and may be extended indefinitely.

Among the first witnesses examined were Mine Inspector David T. Williams, in whose district the Pancoast mine is situated, Superintendent J. V. Birtley, James J. Moran, who had charge of the engine house that took fire, and George Simons, who was passing out of the mouth of the tunnel when the fire broke out in the engine house.

From the testimony of these four witnesses, it appears to be established that the engine house was set afire by a naked lamp falling, exploding and setting the pine flooring afire.

Inspector Williams said that he had heard of the disaster at 1:30 p.m. of the day on which it occurred and that he arrived at the mine at 4:30 p.m. He said that the Pancoast mine was in first-class condition and that its ventilation was perfect.

The inspector declared that there is no law of Pennsylvania to prevent one engineer attending two engines as far apart as those in the Pancoast mine.

Superintendent Birtley, of the Scranton Coal Company, testified that he was in his office when informed that he was wanted in the mine. When he got to the bottom of the shaft, he was informed that the engine house was afire. He stated frankly that hoisting coal was continued while the fire was in progress, but that this coal was taken from the upper veins and the cessation of work could neither facilitate nor retard the work of rescue. He said that he dared not give orders to stop the fan, for there were men in the other veins, and that the China vein is gaseous. He declared positively of his own knowledge that the men working in the China vein, where the holocaust occurred were notified that the engine house at the opening of the tunnel was afire. Moran, the engineer, could not tell how the fire started, but he too declared that the men had been notified by telephone.

During the second session of the inquest a number of witnesses who were in the mine when the fire started or who were lowered later, testified that the men had been warned by telephone, and one or two men who escaped death, testified that they had been notified. A man named Micheson stated that after he had learned that a fire had broken out in the engine house, he notified an aged doortender, Mike Kosey, by telephone of the impending danger and ordered him to warn the men in the China vein, and that Kosey answered "All right." One of the men who was rescued testified that Kosey informed him of the fire. Kosey lost his life.

Another witness, Harry Parfrey, testified that he told John Bray, who was working near the tunnel, of the fire and that Bray went directly to give the alarm to all the men in the China vein whom he could reach. Bray lost his life. A driver named Greshen testified that he obtained the information that the engine house was afire from a runner, and that he personally informed John R. Perry, who was working in a heading, of the fact. Perry lost his life, but one of his laborers escaped.

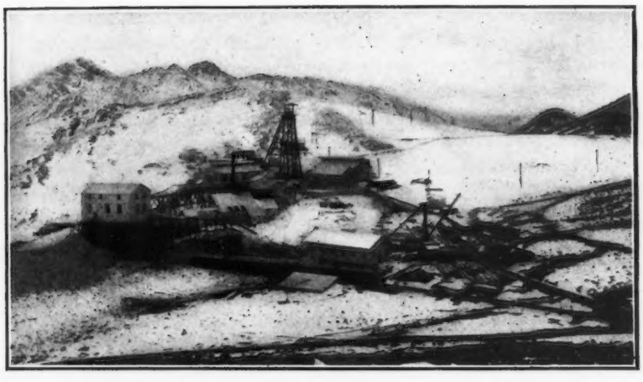
A juror, James Grady, who had been a fire boss for a number of years held the following colloquy with a witness named Henry Simpson: "Don't you think that if they had put up a canvas brattice back of the engine drum to force the air the other way that the fire fighters could have got to a water plug at the other side of the engine house?" "I do not know about that," Simpson answered. "Well, you ought to know," retorted Grady. "You fought the fire from the wrong side. There's where the mistake was made. If you fought from the other side you would have prevented the fire from getting into those mine cars—the 15 cars were standing on a branch at the entrance to the tunnel. It was the cars that caused the trouble. If you had put up a brattice, there would have been a different story to tell." Mr. Grady contended that it was the smoke from the burning cars and not the smoke from the burning engine house that killed the 73 men.

Tonopah-Belmont Surface Plant

By Claude T. Rice

This new plant has many novel structural features, such as saw-tooth roof for hoist house, special ventilating devices in change house and reinforced-concrete roofs and walls for several of the buildings.

The surface plant that the Tonopah-Belmont company has just completed at its new Belmont shaft is one of the best in the country and by far the best in the Nevada, not excepting the new equipment installed for prospecting at the Alpha shaft of the Giroux Consolidated company, at Ely. Everything is uptodate and only in the magnitude of some of the installations in such large Western camps as Butte and Bisbee, where the mines employ more men than is the case at the Belmont mine, is the Belmont equipment at all surpassed, and then only in size. In most of the details of its design, it is far in the advance of usual mine construction, for reinforced-concrete has been used as much as it could be, and every possible thought has been displayed in providing for the comfort of the employees. For instance, in the change room devices are installed to aid the monitor construction in ventilating the building and removing the bad odors that arise while the clothes of the men are being dried. As this plant is so far ahead of most mine construction that it stands in respect to mine surface plants in much the same relative position as does the type of mill construction which has placed the Nacozari mill of the Moctezuma Copper Company and that of the Miami Copper Company in a class by themselves, I have described the plant in considerable detail.



THE TONOPAH-BELMONT SURFACE EQUIPMENT, TONOPAH, NEV.

NEW OREBODY REQUIRED A NEW SHAFT

The Tonopah-Belmont has, during the last year and a half, become almost a new mine, and as the new orebody is far to the east of the old Desert Queen shaft, it became necessary, owing to the long tram and the difficulty of ventilating, to sink a new shaft for the working of this new ore. Fortunately there was an old shaft about 1900 ft. to the east of the Desert Queen shaft that was about over the center of the probable extension of the new orebody. This was down 540 ft. and a compartment and a half wide, and by enlarging it in the upper part and raising from the new workings it has been made into a fine three-compartment shaft.

This new shaft and surface plant, with respect to the old shaft, are over the ridge that connects Mt. Oddie and Rushton hill, but by extending the tracks from the Montana-Tonopah spur it has been possible to get railroad connection without much trouble. The maximum grade is 4.2 per cent. and the sharpest curve 11 deg. 44 min. Old steel in first-class condition and weighing 65 and 70 lb. per yd. was used in laying the tracks. This main spur comes in at a level 40 ft. below the collar of the new shaft and passes directly under the ore bin where trackage is provided to give tail room at the bins for eight steel-hopper railroad cars. The set-out spur is 180 ft. from the collar of the shaft, but an incline railway, of 3-ft. gage, on which runs a car operated by an electric hoist, enables freight to be transferred easily to the collar of the shaft, and the storehouse at the top of the incline. A power-operated crane with a 50-ft. boom is installed at the bottom of the incline so that it can be made to serve both the railroad cars and the incline car during loading and unloading.

Owing to the new shaft being 60 ft. higher than the old Desert Queen shaft, a new water tank had to be installed on Mt. Oddie at an elevation of 150 ft. above the collar of the new Belmont shaft. This enables effective fire protection to be obtained by means of hydrants at the different buildings and two elevated fire-monitor nozzles at the timber yard. Where possible the water mains have been placed in trenches alongside the steam-heating mains so as to guard against freezing, while in most cases these water pipes are carried in sawdust-filled boxes below the ground surface.

TRANSFORMER HOUSE

Electric power for the new installation is brought in at 7200 volts from the Esmeralda Power Company's sub-station, 2900 ft. away, on 30-ft. cedar poles, spaced about 110 ft., and equipped with glass petticoat insulators; at the transformer house near the shaft it is stepped down to 440 volts. The transformer house is the one with the rounded roof shown in the accompanying pictures of the surface plant. It is 12x28 ft. in plan and is built with a structural-steel frame. The walls are of "Hyrib" concrete construction, and the roof is semi-circular in section, being made of rolled, corrugated, galvanized iron. Under this is an anti-condensation roofing of asbestos stretched over poultry netting. There are three type W. C., 400-volt General Electric transformers with a rated capacity of 200 k.v.a. at 60 cycles. The transformers are wound for a 7200-volt primary, with a 6600-volt tap brought out, and a 440-volt secondary. The amperage of the primary is 30.3 and of the secondary, 450. In the transformers No. 8 transil oil is used for insulating, and the cooling water is sent to a cooling tower at the compressor plant. The water is forced through the coils by a 1½-in. Krogh centrifugal pump directly connect-

ed to a 2-h.p. Westinghouse induction motor in the compressor house. In this way the rise in temperature at the transformers is kept well within the limits of good practice, and the transformers have an efficiency at full load of 98.3 per cent.; at three-quarters load of 98.2; at half-load, 97.7; and at quarter load, 96.1 per cent.; with a regulation on a non-inductive load within 1 per cent.

Lightning arresters of Westinghouse, type A, electrolytic, oil-insulated, ungrounded-neutral design, made for a normal voltage of breakdown at 11,000 volts with combination disconnecting and charging horns, are provided for protection of line and apparatus, as Tonopah is in a region of considerable static disturbance. This type of lightning arrester consists essentially of a system of nested aluminum cup-shaped trays, supported on porcelain and secured in frames of treated wood in a steel-tank container. These trays are electrically connected between line and ground and between line and line. In the trays is a liquid electrolyte which forms a film that prevents flow of current at normal voltage, but under an abnormal voltage the electrolyte breaks down and offers a free path for the discharge. Upon cessation of abnormal conditions the electrolyte assumes its former condition and offers its original resistance to normal voltages.

The switchboard is put in the transformer building, and is equipped with recording wattmeter and other features of a modern switchboard, the larger motor circuits being equipped with oil circuit-breakers. The lighting transformers for stepping down the 440-volt current to 110 volts for lighting are also placed in the transformer house.

Belmont Shaft and Headframe

The Belmont shaft is at present 1240 ft. deep, and is being sunk still deeper. It is now the principal shaft of the property, the old Desert Queen shaft having become an auxiliary hoisting and ventilating shaft, as most of the ore in that part of the mine has already been extracted. The Belmont shaft has three compartments, one for ladderway and pipes and two for hoisting. Double-deck cages of the Leadville type weighing 2700 lb. are used in hoisting, but the use of skips is contemplated later. From the shaft stations have been cut at the 1000-ft., 1100-ft. and 1250-ft. levels.

This shaft is surmounted by a steel headframe of the A-type. This was designed and built by the American Bridge Company at its St. Louis plant from preliminary drawings and specifications furnished by the Tonopah-Belmont company. The frame, which is the largest at Tonopah, is 75 ft. high from base to center of sheaves, and 83 ft. over all. The front posts are spaced at 32-ft. centers, and the distance at the base from front-post centers to compression-member centers is 39 ft., giving a base area ample for all purposes of stability, while the resultant of the rope stresses falls almost within the plane of the compression members. The structure is designed so as to give a factor of safety of eight when there is on each sheave a load of 100,000 lb. hoisted at 1000 ft. per min., even when the hoisting moment is the greatest. Consequently, the frame is sufficiently strong and rigid to permit of hoisting loads of seven tons from a depth of 2000 ft., at a speed of 1000 ft. per min. without appreciable vibration and without strain during the most severe period of starting and acceleration.

The posts as well as the main bracing members are made up of built-up beams which in most cases are two channels latticed back to back, and all connections are air-hammer riveted, as there is not a single bolt joint in the frame. The weight of the structural steel used in the frame is over 63,000 lb., and the posts rest on massive blocks of reinforced concrete. The sheave boxings are supported by heavy diaphragms resting on double built-up plate girders that connect the posts at the top, and the centers of the sheaves lie in the intersection (prolonged) of the posts. On the top connecting girders a platform is carried below the sheaves, and also the framework of a housing for the sheaves which is to be erected on the platform.

The sheave wheels are of the bicycle pattern with a diameter of 84 in. at the center of the rope groove, and a diameter over all of 91 in. The 16 spokes consist of eight 1⅛-in. rolled-iron rods radiating from each side of the hub which on their inner ends are cast into two rings, 16 in. in diameter and 3 in. wide, so that they form integral parts of the hub, 12 in. diameter and 16 in. long, while the outer ends are cast into bosses on the inside of the rims. The rolled-steel shafts are 6 in. in diameter in the central portion, while the bearings are 5 in. diameter and 12 in. long. The rope grooves are turned in hard maple blocks fastened in a recess in the rim, while the total weight of the sheaves is 2950 lb. apiece.

Two-reduction Geared Electric Hoist

The cages are fastened to the cable through a detachable overwinding device of the hook-and-clip type, made by the Wellman-Seaver-Morgan company, and are of six tons capacity. The hoist is a Wellman-Seaver-Morgan double-drum electric hoist with drums having 60 in. diameter and a face 36 in. wide between flanges. The hoist is designed to operate in or out of balance, and is capable of handling a load of 12,000 lb., including weight of rope, at a speed of 1000 ft. per min. The drums, which are each fitted with friction clutch and post brakes, are driven through two reductions of spur gearing by a 300-h.p., variable-speed, type H. F., Westinghouse induction motor running at 580 r.p.m. under full load. The gears are cut cast-iron, and the pinions cut steel, the gear reduction being 9.3 to 1. The heavy duty rendered it impossible to use a rawhide pinion, but the noise is eliminated to a great degree by the use of wooden blocks placed between the arms of the intermediate gear.

Brakes Set by Weights

The post brakes are designed so that they are put on by heavy counterweights and released by the action of the air cylinder of the combination air-and-cataract control. The cataract cylinders are steepled upon the air cylinder, with a common piston rod serving both, and are filled with oil to insure quiet operation and freedom from shock. The air cylinders are operated by air from the mine compressor at receiver pressure, but in case of failure of air supply can be connected to operate by water pressure. In case of a failure of receiver pressure, or at times when the mine compressor is not running, a small Allis-Chalmers (Christensen) motor-driven air compressor having a capacity of 15 cu.ft. per min. is so connected that it starts or stops automatically as the receiver pressure falls or rises above a certain point.

The company thought seriously of installing a motor-generator set in connection with the hoist, but as the Belmont company's contract for electric power does not base payments on a peak load, and as the advantages of a direct-current hoist, although great in respect to flexibility and control, did not warrant the extra expense of installation, the idea was given up. At the same time it was desirable to eliminate peaks as much as possible, so a contactor and a controller were devised by the company's electrical engineer, E. P. Cullinan. While with this device there is no automatic regulation during the period of acceleration, when the peaks in hoisting ordinarily occur, the movements of the handle of the manual master controller are such that the natural manipulation of it produces acceleration to maximum speed in 17 sec. with surges of current to the motor that are extremely small as compared with most automatic controls and with a correspondingly substantial saving of power.

The hoist is placed 92 ft. from the shaft so that there is an angle of slightly less than two degrees, and the rope winds perfectly on the drum. Dial indicators run by chain and sprocket wheel are used on the hoist, and an electrical device for showing the position of the cages in the shaft is being installed. The rope used in hoisting is a 6-strand, 19-wire, plow-steel rope, 1 in. in diameter that weighs 1.58 lb. per ft., and each

rope is 1700 ft. long. The diameter of the drum at the starting of a hoist is 64 in., but the rope winds twice on the drums so that the diameter is 66 in. toward the end of the lift. Figuring with proper allowance for bending stresses and not exceeding the proper working load as given by the manufacturers for the rope of 7.6 tons, and making proper allowance for extra rope stresses incidental to jerk on starting, it is seen that the rope is plenty strong enough for hoisting from a depth of 1800 feet.

Hoist House with Saw-tooth Roof

The hoist house is made of steel and concrete, and is novel in its design as can be seen from the accompanying illustrations, for the building has a saw-tooth roof. The building faces north and is 36 ft. long by 24 ft. wide with an ell at the northwest corner 16 ft. long by 9 ft. wide. The building is without windows in the walls save for the one in the west wall of the ell. The roof is in two "saw teeth": the front one is 24 ft. in span, and the rear one 12 ft., measured with the length of the building. The front of the rear saw tooth is taken up entirely by windows giving a glazed area of 140 sq.ft. The front of the forward saw tooth is carried in line down to the ground level for a space 10 ft. wide in the central part of the main building, so that a space 10 ft. wide and 16 ft. high directly in front of the drum is of glass. Consequently, the hoisting engineer has an unobstructed view not only of the collar of the shaft, but also of the whole hight of the head-frame. At night the frame is brightly illuminated by a 3000-c.p. regenerative flaming-arc lamp fixed above the sheaves. The interior of the hoist house is kalsomined in white, and the north lighting from the saw-tooth windows, with an almost entire absence of shadows, makes for the best possible working conditions for the operator. The building is steam heated.

This hoist building is of steel and concrete, built on the Kahn system of reinforced-concrete construction from designs made by the Belmont company. The structural-steel frame is covered with Hyrib, a patented painted steel lath stiffened by rigid ribs, 13/16 in. high and spaced 3½ in. apart, that run longitudinally through and along the sides of the sheets that are 10½ in. wide; these ribs also serve to make an overlapping interlocking splice at the ends. Hyrib lath of 26 gage is used for roof and of 28 gage for side walls. This lath is secured by means of steel clips to the outside of the steel frame of the building, and this frame is made somewhat lighter than would be the case for sheet-iron covered buildings. This steel lathing when in place is so rigid that studding or purlins can be dispensed with closer than at 5-ft. centers. No centering is necessary for the concrete style of roof construction.

Method of Putting Up Hyrib Buildings

The roofs of the hoist house were made by plastering on the top side of the Hyrib a layer of concrete, 3 in. thick, composed of 1 part cement, 2 parts sand and 4 parts small broken stone. This formed the scratch coat, and after it had dried both its upper and its lower side were plastered over with a cement mortar composed of 5 parts cement, 12 parts sand and 1 part hydrated lime, with enough chopped fiber to key to a thickness of from three-quarters to one inch. The exposed surface was troweled smooth and painted with a cement-roofing paint. The finished roof is 4½ in. thick, and has shown no cracks under severe conditions of wide variations in daily temperature, so the roof appears to promise to continue waterproof.

The walls were treated somewhat differently, no broken stone being used, as the mortar for plastering the sides was mixed in the proportion of 5 parts cement, 12 parts sand and 1 part lime paste, to which was added some cut fiber, as before. This plaster was applied to the outer side of the wall lath and surfaced off to cover the ribs, but this working of the plaster only caused enough to go through the openings in the Hyrib to secure a good clinch on the expanded metal between the ribs. This first coat was given a scratch finish, and on the outer side was plastered another coat of similarly proportioned composition, but mixed with water to which a patent waterproofing compound called "Truss Con Waterproof Paste" had been added. This surface coat was floated to a flat impervious finish. On the inside of the wall a thin interior-finishing coat was plastered and troweled smooth, giving the completed wall a thickness of 2½ to 2¾ inches. The hoist building presents a fine appearance, and the lighting and the whole treatment of the design, while somewhat of a departure from commonly accepted practice, seems to leave little to be desired, and may profitably be copied in similar installations.

Ore House

The new ore house at the Belmont shaft is built over the main line of the railroad spur and is 220 ft. easterly from the collar of the shaft, to which it is connected by a trestle, on which are arranged double tracks for the mine cars. The design of the bin is novel for ore bins, at least in the West and is patterned somewhat along the lines of bins at some of the Eastern cement works, for the main side posts extend continuously from the bottom to the top so as to give great stability to the whole structure, while the floor of the bin is carried on auxiliary posts alongside the main posts. As the design is novel in mine practice it has been considered best to describe it in more detail in another article, as will also be done in regard to the efficiency tests on the air compressor.

The storage bin is divided by a partition longitudinally through the middle as well as transversely at one-third the length. This provides two larger compartments for the mill ore that has been sorted on the dry-picking tables above the bin proper and in the superstructure of the ore bin itself, while the smaller transverse compartment is for the shipping ore that has been sorted on the Crane ore washer, placed in a separate building, which feeds to the bin by means of a conveyer belt. The two compartments for mill ore have a capacity of about 10,000 cu.ft., and so hold about 525 tons of the light Tonopah ores, while the bin for smelting ore has about half this capacity, making a total capacity for the bin of approximately 750 tons. The grizzlies used in separating the fines from the coarse mill ore that is sorted on the dry-picking tables are novel in that they are made of cast manganese plates, one inch thick. The holes in these are arranged in staggered rows, and are 2 in. in diameter at the top and 2¼ in. at the bottom. These plates are set at an angle of 40 deg. and clean themselves well; the holes show no tendency to bind. These manganese plates are cheaply obtained from the local foundry as it has an abundance of manganese to put in its castings, as a large proportion of its metal is old manganese shoes and dies from the mills of Goldfield and Tonopah, and are fully as cheap as grizzly bars would be. The oversize from the grizzlies goes to the picking tables where the waste is removed and thrown into mine cars and trammed to the dump, while the sorted mill ore is scraped off into hoppers that take it to the bin compartments.

Ore-washer Building

Northeast of the shaft about 100 ft. is the pocket for the smelting ore. This is made of timber and has inside measurements of 16x16x19 ft., giving a capacity of about 125 tons. The pocket has no bottom, but instead the whole structure rests upon concrete sills and the ore makes its own bottom. The bin is housed with corrugated-iron covering. From it the smelting ore feeds through a chute to a short conveyer belt which takes the ore to the trommel of the Crane ore washer. This trommel has 1-in. holes; the undersize goes to the traveling belt that takes the smelting ore to the main ore bin, while the oversize is taken up through a tank of water and then drained by a series of spiral flights riveted to the inside face of the inclined washing cylinder to which the trommel feeds its oversize. This washed ore then falls on

a traveling picking belt, 40 in. wide and 25 ft. long. As the ore travels along, the waste is sorted out and thrown to one side of the belt. The picking belt feeds waste to a conveyer stacking-belt that takes it to a dump on the other side of the track from the washing shed, while the ore goes to a conveyer belt that takes it and the dry undersize from the trommel to the ore bin.

The building in which the ore washer and picking belt is installed is 20x60 ft., with an ell for the boiler room, 16x38 ft. This is built with a wooden frame and a corrugated-iron covering, while large skylights in the roof furnish good light to the ore sorters. The conveyer belts leading from the washer house to the ore bin are also covered in, while on the top floor of the ore house a small motor-driven crusher is installed for crushing the mine samples before sending them to the assay office.

Boilers Use Oil Fuel

In the boiler-room addition to the washery building is a tubular boiler, 66 in. diameter by 16 ft. long, for furnishing steam to heat the various buildings during winter, while a small auxiliary vertical tubular boiler, 36x84 in., is provided for heating the dry house and furnishing hot water for baths when the weather is so mild that the large boiler is not needed. These boilers are heated with fuel oil, and Whittierfield crude oil of 18 deg. gravity is used, as it does not need to be heated in cold weather. The oil is unloaded by gravity into two tanks having a capacity of 7500 gal. each, placed below the main railroad spur, and from there is pumped to a housed-in supply tank on the hillside above the plant. All oil pipes are placed in sawdust-filled boxes and are carried in the trenches alongside the steam pipes wherever possible.

The air compressor is a belt-driven, variable-capacity Nordberg machine, having air cylinders 15 and 24 in. in diameter with a 36-inch stroke. It has a capacity at 80 r.p.m. of 1500 cu.ft. of free air per min. to 90 lb. per sq.in. pressure, and at 100 r.p.m. 1800 cu.ft. per min. At present the machine runs at 84 r.p.m. and compresses 1580 cu.ft. of air per min., but later will be run at 100 r.p.m. The compressor is an efficient machine, especially under widely varying loads, and it is most successful in maintaining a constant pressure while the volume of air delivered is only that required by the constantly varying consumption, such as prevails at any mine. Consequently, the power consumed is nearly proportional to the amount of air delivered This air regulation is effected by automatic closing of the inlet valve to the air cylinder.

The building in which the compressor is housed is of reinforced-concrete construction with a steel frame, erected in a similar manner to the hoist house, but with a monitor roof. It is 26 ft. wide and 64 ft. long, and is equipped with an overhead gantry crane provided with a five-ton Matchless crawl that runs the length of the building on floor tracks spaced at 22 feet.

Blacksmith and Machine Shops

The blacksmith and machine shops are housed in a corrugated-iron covered building with a steel frame that is 30x54 ft. in plan. This is located about 35 ft. east from the shaft, with the front facing the shaft. A transverse partition divides off the two shops, the blacksmith shop being 30x32 ft. in size, but a track from the collar of the shaft runs into both shops. Twelve side windows furnish ample light, while in the monitor roof of the building, windows are placed over the machine shop and louvres over the blacksmith shop. The blacksmith shop has a dirt floor, while the machine shop has a plank floor.

The blacksmith shop is furnished with a Word drill sharpener and a Tate-Jones oil forge for heating drill bits. The heating furnace has an opening 3 ft. long and is fired with two burners at the ends. The oil for this forge is contained in a 420-gal. steel tank placed just outside the building, and this tank is filled intermittently with oil so that an air pressure of 20 lb. per sq.in. can be maintained in the tank by reducing valve connection with the air receiver. In the tank there is a steam coil for heating the more viscous oils, while air for atomizing the oil is furnished the burners at a pressure of 15 lb. by a second reducing valve which connects also with the main air receiver.

Air for combustion is furnished to the furnace at 6-oz. pressure by a No. 4 motor-driven Sturtevant blower, and this blower also furnishes the air for the coal forges, as the more or less wet air from the compressor is unsuitable for these fires. A general forge and a tool forge are provided which can be fired with coal or coke as desired, and in the shop are the usual anvils, benches, small air hammers and other apparatus. The machine-shop equipment consists of a 16-in.x8-ft. Hamilton back-geared screw-cutting lathe, drill presses, power hack-saw, pipe machine for pipes up to 6 in. diameter, emery wheels, and a punch and shear for plates up to ⅜ in. thick. The whole is driven by line shafting from a 5-h.p. Westinghouse motor.

The change or dry room is 30 ft. wide by 72 ft. long with a partition 12 ft. from one end, making a wash room 12x30 ft. and a locker room 60x30 ft. The building is of steel construction with a gable-and-monitor roof, and is covered on roof and sides with galvanized corrugated iron fastened with clinch nails to the frame. The inside walls are made of one thickness of building paper fastened to wooden nailing strips, over which is nailed galvanized iron. The roof is lined inside with asbestos roofing, laid on tightly stretched poultry netting, as a preventive of condensation. The floor is of concrete, 4 in. thick and reinforced with barbed wire stretched longitudinally and transversely through the bottom layer of concrete, while on top of this is a grouting of neat cement. Numerous windows in the side walls and the monitor roof insure good lighting. The change room is ventilated by means of two No. 16 Autoforce air-pump ventilators having each a capacity of 75,000 cu.ft. of air per hour in ordinarily calm weather and more in winds. These have proved most efficacious in keeping the air in the building pure and odorless. The building is steam heated, and sufficient pipe surface is provided to keep the rooms at a temperature of 80 deg. F. in the coldest weather.

Change-room Equipment

In the change house are 300 expanded-metal lockers, 12 in. wide, 18 in. deep and 6 ft. high, placed in banks of 12, with six on each side and a common back between. Under each line of lockers are four 2-in. steam pipes for drying the clothes. The rows run crosswise in the change room with a bench between rows, and in order that there will be no crowding, the night and the day shifts occupy lockers on opposite sides of the benches.

The wash room is fitted with two shower baths with dressing rooms attached, as well as with sinks containing enameled wash basins. The hot water is piped from a 600-gal. steel tank heated by means of a steam coil that is fed with steam from the heating systems. In summer when the large boiler is idle the water in this tank is heated by a coal-fired ideal hot-water heater placed directly beneath the tank, and in the same housing behind the change room. At first it was the intention to build the change room of Hyrib concrete construction, but as the building is on made ground, it was decided that it would be safer to use the galvanized-iron covering on a steel frame, and this has proved satisfactory for the air space between the two coverings of iron has afforded a good insulation against cold and heat.

Timber-framing Mill and Yard

The timber-framing mill and carpenter shop is housed in a wooden-frame, corrugated-iron building, 24x60 ft., about 230 ft. north of the shaft between the main spur and the set-out switch. It is equipped with a Hendrie & Bolthoff timber framer, a 36-in. cutoff saw, a 36-in. rip saw, with its carriage in a lean-to on the west side of the main building, a

band saw, power grindstone and the usual benches.

The lumber-storage yard is in the Y made by the railroad tracks. Mine timber is handled from the railroad cars by a power derrick and by hand, and enters the framing mill from storage piles on small cars that travel on tracks running to the various parts of the yard. After framing, the timber is brought to the shaft by a switch from the incline railway that connects with the south end of the framing mill, so that the whole timber plant is well arranged to get the timber to the shaft with the least possible handling.

The storehouse, 20x48 ft. in plan, is 40 ft. north of the shaft, and has a steel frame with a Hyrib concrete covering. A receiving platform on the west side is arranged conveniently alongside the incline railroad. In the building, bins and racks are provided for supplies, while for fire protecting a sprinkler system will soon be installed. Pipe, bar iron and steel are stored in locked racks adjacent to the incline railway, while oils are stored in a small corrugated-iron building on the incline railway. Explosives are stored in a magazine in the old G. H. tunnel about half-way between the Desert Queen and the Belmont shafts.

New Office Building

The company has built a new office building on the ridge that connects Mt. Oddie and Rushton hill, about 450 ft. west of the Belmont shaft, and it is on the ground between there and the shaft that the site for the new mill will be chosen in case that it is built. The office building is a two-story frame, 25x43 ft. in plan, with shingled hip-roof. The outside walls are of cement plaster on metal lath, while the inside finish is hard wall plaster on wood lath. On the first floor are the general accounting office, and those of the superintendent and the purchasing agent, while on the second floor are the drafting room, a blueprinting room with dark room, etc., attached, the mining engineer's office, bath and toilet, together with a small locker room. A two-story, reinforced-concrete vault, 7x8 ft. inside and with walls 18 in. thick, equipped with fire- and burglar-proof doors, opens into the general office on the first floor and into the engineer's office on the second, so that the books, accounts, drawings and engineering data are well protected from fire.

In short, everything about the plant and the office building has been done with the object of obtaining the highest efficiency, as the superintendent has considered money well spent that aids the men in their work and renders them more comfortable. Consequently, it was with the greatest regret that I learned only recently the details of the unfortunate accident that occurred at the mine. The coroner's jury censured the management for inexperience, but anyone knows that such a plant as the one which I have just described could be designed only by a man of broad experience, and one who had great solicitude for the welfare and the comfort of his employees, as in no respect has money been spared when its expenditure would increase the safety of the men, or any reasonable amount would add to their personal comfort.

The Recent Fire

The general superintendent, the mining engineer, the mine superintendent and the bosses were all fighting the fire, which at first seemed to be of small importance, but it increased so rapidly in magnitude, especially in respect to the volume of smoke and gases given off that before the bosses could get to the men through the 1000-ft. level that connects the old workings of the Desert Queen shaft with the new ones of the Belmont, the fire had changed the Belmont shaft from a downcast to an upcast, and the men who had been talking and smoking in a crosscut, in good air near the Belmont shaft while it was a downcast, were caught in poisonous gases when the direction of ventilating currents suddenly changed.

The design of this plant is sufficient contradiction of the charges of the coroner's jury, and it therefore is with a desire to refute that accusation as well as to describe this most interesting and uptodate plant which embodies so many new features in its construction that I have elaborated my notes so fully. In conclusion, I wish to thank Frederick Bradshaw, general superintendent of the Tonopah-Belmont, as well as R. J. King, mining engineer, and T. F. Fitzgerald, the mine superintendent, for the many kindnesses shown me while at the mine.

Transvaal Mining Notes

Johannesburg Correspondence

The circular shaft now being sunk on the New Modderfontein mine is exciting considerable interest, and opinions are divided as to the suitability of such shafts for work here. It is being sunk to cut the reef at 2000 ft. and it is said that an average speed of 150 ft. a month, including unwatering, is anticipated in this work. Whether these expectations can be fulfilled is a question.

The shaft is 15 ft. in inside diameter and 22 ft. outside, and has two hauling compartments in which three-deck cages carrying two trucks on each deck will work. Six trucks will be raised at a time, or four tons. The speed of winding will allow a hoist being made in 45 sec. The dead weight carried compares badly with skips, and the total load per hoist is only four tons as against 10 tons now in use at Kimberley; while the handling of the trucks is, of course, much more difficult than tipping a skip.

Uniform Value of Reefs

The yearly reports of development of some of the mines show examples of the wonderful regularity of values found over large areas here. For instance the following table shows results obtained in 1909 and 1910 in several mines:

	Feet of Drifts	Av. Width of Reef Inches	Av. Value, Dwt.
Village Deep:			
1909	13,303	28	10.9
1910	15,522	31.5	9.8
Geldenhuis, on Main Reef:			
1909	9,791	21	9.7
1910	10,163	23	9.5
Main Reef Leader:			
1909	10,864	10.1	19.1
1910	6,534	10.2	23.9
South Reef:			
1909	5,023	15.8	13.6
1910	5,306	15.0	16.7

The Robinson Mine

The report of the Robinson mine shows that the policy of increasing output and lowering the grade of ore has been continued, as shown in the small table:

Year	Tons Milled	Value per Ton	Cost per Ton	Total Profit
1909...	550,176	46s 9d.	12s 6.56d.	£940,911
1910...	638,900	41s 6.4d.	12s 2.48d.	936,756

In 1910 36 per cent. of the ore milled was Main Reef ore against 11.8 per cent. in the preceding year.

The ore reserves on the south reef and main reef leader amount to 1,448,189 tons carrying 11.77 dwt. over 74 in. thickness, besides 350,000 tons in pillars. Of the main reef there are developed 2,202,437 tons of 4.24 dwt. over 80 in. In all 528 claims have been bought from the government and these will yield some 500,000 tons of ore. Much of the main reef is already exposed, lying on the foot-wall of the old main reef leader stopes and is mined cheaply. Sand filling is being carried on and a fan installed to deliver 45,000 cu.ft. of air per min. to the lower levels.

The Katanga Mines

Official news from Katanga is to the effect that on Dec. 30, 1910, the foundations for the smelting plant were completed, but that owing to the heavy rains the plant could not be completed in April. One crosscut at the Star of Congo mine went through 150 ft. of 15 per cent. copper ore. Coal has been found in Northern Rhodesia some 300 miles distant from Katanga assaying 67 per cent. fixed carbon and 33 per cent. volatile matter. It is anticipated that 7,000,000 tons can easily be proved and that the coal will prove suitable for smelting purposes.

It is understood that duralumin, the new alloy, is used for the metal work of the new British naval airship constructed by Vickers, Sons & Maxim. This airship is said to be 560 ft. long, to have a lifting capacity of 21 tons, and to require 706,330 cu.ft. of gas.

Speisses and Their Beneficiation

By C. Guillemain

Origin and treatment of speiss discussed. Low-arsenic speiss successfully blast-roasted if diluted with inert materials. High-arsenic speiss can be treated without dilution.

NOTE—Translated by O. H. Hahn from *Metallurgie*, Vol. VII, No. 19.

Among the various by-products arising during the treatment of ores by smelting the speisses are by far the most troublesome as they offer especial difficulties to the separation and extraction of the valuable metals absorbed by them. For this reason it was the custom even at large works to discard them as undesirable waste products or reserve them for treatment by a process not yet discovered. Like other similar by-products the speisses show a problematic composition in regard to the grouping of their constituents. Thus, for instance, it is difficult to classify them with the definite chemical compounds subject to Dalton's law of multiple proportions. If it be desired to do so for the large number of possible speisses, the following general formula may be established:

$$a[(Fe, Ni, Co, Pb, Cu, Ag_2, Au, Pt, Zn, Cd)_x (As, Sb, S, Bi)_y] + b[(Fe, Ni, Co, Pb, Cu, Ag_2, Au, Pt, Zn, Cd)_{x_1} (As, Sb, S, Bi)_{y_1}].$$

In general they may be considered as isomorphous mixtures of single types of the general formula $Fe_x As_y$, in which Fe may be isomorphously represented by Ni, Co, Pb, Cu, Ag, Au, Pt, Zn, and As by S, Sb and Bi.

It is, however, much more probable that they have to be ranked with the large groups of undefined chemical compounds, not following Dalton's law, in which solutions and alloys are usually reckoned.

The property of intermixing in various proportions at proper temperatures and of forming from components differing in composition a new well characterized, frequently crystalline mass; the property to dissolve in lead, or to dissolve other pure metals, e.g. Fe, Cu or Ni, brings them unquestionably nearly in line with alloys. Alloys, that is to say, compounds which do not follow Dalton's law, have long been known to exist among metalloids. Hence, the definition of an alloy should be enlarged to embrace all undefined chemical compounds, that is, mixtures of any elements whatsoever with each other. The speisses would then be grouped with these. Unquestionably clues will be found for the composition of speisses within this group by further researches into their consitution as has been done already for the definition of eutectic alloys.

THE ORIGIN OF SPEISS

We will now contemplate the origin of speisses in metallurgical processes and see how far it is adapted to sustain these views. In smelting lead ores or fluxes such as iron finery slag, spent pyrites, zinc-muffle breakings, lead sulphate, etc., containing the elements which come into play in forming speiss, viz.; Co, Ni, As, Cu, Sb. Ag, Au, Pt; these elements are reduced and enter the lead, forming what is known as furnace bullion. This is, therefore, an alloy of lead with all these elements to which S, O and Si may come in addition. Part of these admixtures will segregate when the metal is cooled forming *werkbleischlicker*" or lead dross on the surface. This contains the largest portion of impurities in the principal metal and owes its segregation to the formation of specifically lighter insoluble compounds, somewhat in the same manner in which from a solution of a substance saturated at a certain temperature, other substances more difficult of solution, but present in small quantities only, will segregate on cooling. It would lead too far to enter into the details of the theory of this unmixing process, suffice it to refer to the work of van t'Hoff on the origin of natural salt deposits where the similar phenomena occurring in solutions are discussed at some length, which will throw light on the subject in question. The only difference is in the solvents and the temperatures applied.

REFINING BY SEGREGATION POSSIBLE

The property of unmixing, peculiar in a particular measure to lead alloys, has been variously used for the further treatment of furnace bullion. Thus the liquation of argentiferous copper-lead alloys, and the Pattison and the zinc-desilverization processes are based upon it. Although by slow cooling and repeated removal of the solidified crusts even a strongly alloyed lead would yield a certain portion of pure lead or, by repeated coolings below the melting point and reheating ultimately all the foreign metals might be eliminated, these processes are generally too slow and expensive in practice. Especially the last traces of the impurities whose quantity frequently plays an important part in the commercial uses of the metal, are retained according to the law of masses. For this reason in practice usually no importance is attached to a complete removal of the speiss-forming metals in the furnace dross (*werkbleischlicker*), particularly if the quantity of the foreign metals admixed is such that a refining operation in the softening furnace has to precede the desilverizing process. If the quantity of impurities is inconsiderable, that is to say, if ores and fluxing materials are clean, the small amount of *schlicker* may be concentrated by systematic smelting to a speiss in the case of As and Sb being present while in the presence of S the foreign metals will be separated as a matte.

With larger quantities of foreign metals the separation will take place not only in the *schlickers* but also in the drosses from the softening operation, while a portion will enter the matte if any be formed. The speiss separation will then have to be looked for principally in the reducing smelting of these by-products according as they contain As and Sb and one may work for a concentration by smelting them jointly. If the quantities of foreign metals in the furnace charge are large speiss will be formed in the first reducing smelting along with matte, furnace bullion and *schlicker*. According to the proportion between the foreign metals, the operation of the furnace, the course of reduction, the smelting temperature and the composition of the ensuing slag under otherwise equal conditions a speiss of varying composition will be produced. The speisses from other smelting processes, for instance copper, will show a similar behavior.

DIFFICULTIES IN SPEISS TREATMENT

Beside the difficulty of procuring a uniform product to start on, the relatively low melting point of the speiss (between that of pure metal and matte) constitutes a further one in speiss treatment. Actually the difficulties were so great that formerly the beneficiation of the speiss was only undertaken, as for instance at Freiberg, when the problem of the recovery of notable amounts of precious metals like Ag, Au and Pt presented itself while Pb, Cu, Sb and As were largely sacrificed[1]. At various works, speisses containing from three to 8¾ oz. Ag were given up as worthless after numerous fruitless trials of roasting them in heaps, stalls and reverberatories. It seemed, therefore, well worth while to subject the possibility of a further beneficiation of these speisses to a closer examination. With this end in view a number of years ago a series of tests were made on speisses produced at a certain smeltery, the analyses of which gave the compositions as shown in the accompanying table. These will give an idea of the variety in

[1] *Cf.* H. F. Collins in the ENG. AND MIN. JOURN., Feb. 23, 1905, according to whom, at Laurium, Greece, speisses with 1 per cent. Pb; 3 oz. Ag per ton; 63.8 per cent. Fe [Co, Ni (?)]; 20.75 per cent. As; 0.63 per cent. Cu; 4.61 per cent. S; were thrown over the dump as worthless.

the composition of the speisses at the same works under varying conditions.

I will here outline the few methods which, according to the numerous experiments made, seemed to offer some prospect for practical realization. I also refer the reader to a paper by Hübner, which discusses a series of such possibilities[2].

Removal of Arsenic First Problem

As a *conditio sine qua non* for further decomposition and beneficiation a removal of As (or Sb) has to be striven for, whereafter by repeated smelting and slagging of the Fe, a concentration of valuable metal with separation of part of the reduced metals ensues, or, by introduction of S in the form of poor matte or other sulphur-bearing raw or intermediate products (lead sulphate, spent pyrites, pyrite, etc.), a matte essentially easier to work is produced. It was, therefore, obvious to seek first to effect a simple, perfect and economical roasting of the speiss, leaving aside renewed experiments in that direction in heaps, kilns, stalls and reverberatory furnaces, since these, owing to the variability of the material and the easy fusion of some speisses which takes place before the temperature required for oxidation and volatilization of As to As_2O_3 is reached, offered little prospect of success. My later experience has proved that these speisses can be roasted well in a reverberatory furnace if the material is finely pulverized and intimately mixed with substances impeding quick fusion. I may state beforehand that ground limestone, speiss already roasted, iron oxide in any form (purple ore) have proved to be most appropriate. Mechanical power for crushing the materials, low wages for the long and onerous furnace work, and cheap coal are important factors to carry this roasting method to a successful issue.

Speiss Converting

Melting of the speiss and its treatment in the molten state by a strong air current forced into or on the speiss bath appeared to be promising. Indeed experiments on that line especially with air rich in oxygen yielded favorable results. The heat evolved in consequence of the oxidation of As and Sb, and probably of iron, suffices to keep the speiss liquid and accessible to the blast without any further supply of heat from the outside and to volatilize the As_2O_3 and Sb_2O_3 formed. A process analogous to the bessemerizing of copper could be well adapted to speiss if an appropriate material for lining the converter could be found. The speisses have the property of dissolving not only the metals, especially iron, copper and bronze, rapidly, but also slagging and thereby destroying fireproof material, acid as well as basic. The most resisting material proved to be graphite mixed with fireclay which could, however, not be packed tight enough to protect the walls of the vessel from corrosion. Perhaps the melting might be effected in an electrical furnace in which the thickness of the walls is no impediment to the transmission of heat and melting and oxidation could take place in the same vessel. Experiments in that direction could not be made at the time, so we can only make the suggestion.

[2]"Glückauf," 41, 1905, p. 6.

Chlorine Smelting Unsuccessful

Corresponding difficulties presented themselves in treating a speiss by a current of dry chlorine gas, although the removal of As and Sb was a perfect success. The cost of treating large quantities of speiss by this method was excessive. Subsequently a chloridizing roast with NaCl; or H_2SO_4, MnO_2 and NaCl was tried. This scheme appears advantageous in case at least a part of the metals are extracted from a solution of the roasted speiss by electrolysis. At the present time wet chemical methods are out of the question for poor speisses on account of their excessive cost. So even for a successful electrolytic treatment a preceding removal of arsenic and concentrating smelting seem to be indispensable.

Blast-roasting Experiments

Further experiments were now made to carry out dearsenicization without fusion, or at least, to localize fusion so that it could not exercise its injurious effects. A study of the new lead-ore roasting methods furnished the foundation for the views gained and published in *Metallurgie* 2, p. 1-11. The observation that the heat of combustion of sulphur may be utilized to effect and maintain the roasting process for lead-sulphide ores without any other fuel prompted me to carry out a similar method for the corresponding arsenides and antimonides. In fact, the figures given hereunder demonstrate that in the oxidation of arsenic and antimony a considerable evolution of heat must take place which is well adapted to maintain the roasting processes: $S + O_2 = +69.3$ cal.; $As_2 + O_3 = +156.4$ cal.; $Sb_2 + O_3 = +166.9$ cal.; referred to molecular weights. Since speiss is far easier to melt than lead-sulphide ores combined with gangue or limestone and the evolution of heat is here much greater, as a trial with pure speiss proved by fusing immediately upon forcing blast through it, means had to be found to prevent the melting of the whole mass. This was achieved by mixing the finely ground speiss with infusible substances like limestone, acid slags (from copper-matte smelting), sand or fragments of firebrick.

Method Varied to Suit Material

From the composition of the speiss, and its fuel content (As, Sb, S), the quantity of substances to be added could be calculated in every case. The mixture was, according to its composition, either wholly heated to a dark red heat, drawn into a converter and air forced through or, only a part was heated, raw mixture added and then blown. In this manner the greater portion of the As and Sb was volatilized as As_2O_3 and Sb_2O_3 with the gases. These oxides could be collected in a flue. Only after the removal of the largest portion of As and Sb sintering took place. My explanation in this case is that the heat liberated by the oxidation of the speiss particles is taken up by the material of high specific heat lodged between the particles of speiss, which thus acts as storage and equalizer. Thereby a solid product is obtained, in opposition to the one produced by roasting in a long-hearth furnace. If properly fluxed before blowing no more fluxes were required in the subsequent smelting for concentrated speiss. Besides this speiss which contained Ni and Co and part of the lead and silver, a furnace bullion with the balance of the lead and silver would be obtained. By adding poor copper-lead matte the copper of the speiss would go into a new copper matte which would contain some Ni and Co and also Ag and Pb. For completeness' sake the results of a test made with the greatest accuracy by this method are here appended.

The figures nearly agreed with the theoretical ones, only in the flue dust there was a large deficiency which, without doubt, must be attributed to the insufficient collecting and condensing apparatus. The total quantity worked upon amounted to about 12 tons of raw speiss.

COMPOSITION OF SPEISSES

Pb, Per Cent	Cu, Per Cent	NiCo, Per Cent	Fe, Per Cent	As, Per Cent	Sb, Per Cent	S, Per Cent	Ag, Oz. per Ton
6.25	10.7	5.1	32.55	8.1	10.5	.....	....
.....	5.7	4.6	.....	10.9	6.0	.....	....
.....	5.5	3.7	.....	10.8	6.4	.....	....
4.17	22.15	2.75	43.2	13.5	1.1	.....	....
10.65	8.4	9.74	.....	19.74	.....	.....	....
8.4	4.83	2.0	28.1	0.5	1.5	.....	....
5.26	8.26	1.5	33.33	9.12	3.01	5.56	....
10.2	6.85	1.35	47.5	5.5	3.01	11.0	9.92
9.9	6.35	6.5	48.5	10.61	1.6	5.52	2.33
2.3	7.3	7.05	.....	10.6	5.5	.....	4.37
14.21	7.88	3.8	32.66	22.7	13.23	4.6	....
5.27	10.32	5.82	48.15	13.9	10.5	.....	.....

Part of the Ni and Co went into the matte which contained about 2 per cent. By the addition of corresponding quantities of poor lead matte to the roasting charge the temperature for roasting can be easily regulated, as also the amount of Cu and Pb to be collected in the matte. By a subsequent concentrating smelting of the partially roasted matte almost the whole content of Co and Ni was recovered in a speiss containing 6.5 per cent. Ni and Co. A further concentration of the speiss containing 12.5 per cent. Ni and Co from the original speiss containing 3.4 per cent. Ni and Co could not be undertaken for want of sufficient material. If the concentration can be carried out in the same ratio a second smelting should yield a speiss of 45 per cent. Ni and Co, a result which has never been attained by the methods heretofore employed. According to the deductions of Günther the further treatment of a 45 per cent. Ni and Co speiss by electrolysis would not meet with any special difficulties; one of the many possible methods of treatment in the wet way would also recommend itself in this case. (For example, the decomposition could be easily accomplished by H_2SO_4.) From the proceedings described it follows that a simple and not inexpensive way has been found to beneficiate poor speisses by concentration and subsequent wet or electrolytic treatment.

BLAST ROASTING OF SPEISS.

	Pb, Per Cent.	Cu, Per Cent.	Fe, Per Cent.	NiCo, Per Cent.	Ag, Oz.	As, Per Cent.	Sb, Per Cent.	S, Per Cent.
Raw speiss	9.9	6.65	48.5	3.4	6.12	18.5	3.4	6.2
Flue dust	1.6	....	....	.....	2.33	47.8	11.4	0.88
Speiss, obtained by smelting in the blast furnace	4.75	8.15	30.8	11.25	7.29	20.6	0.95	....

Further Blast-roasting Experiments

These experiments were already concluded in 1905 and recorded in writing, but not published. Meanwhile, in 1908, the process was patented[3]. Stress of other business prevented me from taking up the subject again until 1909, when further researches were made on a series of speisses from Laurium and from a smeltery at Overpelt (Belgium). The results of my previous labors were fully corroborated by the work on the new speisses on which also new observations were made which are of some moment for the application of the process.

The ignition of the raw material can be effected just the same as with lead ores by a small fire of coke, coalslack or wood; even dry leaves, brushwood, shavings, etc., may be used. The *modus operandi* is as follows. A thin layer of limestone broken up to egg-size is placed on the perforated iron plate forming the converter bottom, on this is placed a shovelful of live coals and on that fuel is piled up and the blast turned on to set it fairly on fire. Then another thin layer of limestone is put on and the charging of the speiss mixture begun. In this manner the perforated plate serving as a grate is protected from immediate contact with the fire and kindling material and a direct action of the fire prevented which would cause the lower speiss particles to slag too fast and solidify prematurely. In consequence of that the access of air to the upper parts of the charge would be interrupted, which is to be avoided. It is advisable to perform the charging in two sections commencing with one-fourth of the mixture and adding the balance when the reaction begins. In this way as much as 2500 kg. (5500 lb.) of charge were successfully roasted down to from 3 to 5 per cent. As in about five hours.

Slacked Lime Unsatisfactory

It was of theoretical and practical interest to notice casually that slacked lime instead of ground limestone would not do. From this it may be inferred that actually, as was surmised long ago, the particles of limestone in losing their CO_2 by heat, suffer a loss in volume and thereby a desirable porosity and accessibility of air as also a local consumption of heat for the expulsion of CO_2 is attained. Slacked lime, by melting together with the densely packed speiss particles, forms a solid mass which cuts off the passage of air and thus stops the further oxidation of As and Sb.

Adapt Flux to End in View

The fluxes named above (sand, slag, etc.), chemically indifferent by themselves, cannot be used in every case for reasons of utility. For instance, where it is intended to use the iron contained in roasted speiss, poor in Ni and Co, as an iron flux in the blast furnace as is done at Overpelt, an addition of silicious material would not be economical. In this case basic slag or limestone should be used. Speiss rich in Ni and Co which has to be roasted for the purpose of a further concentration by smelting should be fluxed with acid slags or sand. In every case it is commendable to test slags before use for the FeO they contain. Such slags rich in FeO are by no means indifferent in the blast-roasting process, they will furnish on their part considerable quantities of heat through oxidation by the blast. Products rich in oxide of iron are especially well adapted for fluxing purposes; for example, speisses which have been roasted down to 3 or 5 per cent. As in the reverberatory furnace.

In the same way will roasted products of the converter be applicable after having been crushed to the proper size. From that it may be inferred that from an economical point of view spent pyrites, which often contain As and Zn, rendering them unfit for the iron-blast furnace, and iron ores contaminated by the same elements, will become valuable fluxes.

Peculiar Action of High Arsenic

An unexpected behavior apparently opposed to theory is shown by speisses rich in arsenic. While a whole series of speisses previously experimented upon, also old speisses from Laurium recently under treatment with the following contents: Pb, 2.75 per cent.; As, 19 per cent.; Cu, 1 per cent.; Sb, 0.42 per cent.; Ni plus Co, 0.50 per cent.; Ag, 30 oz. per ton, could be roasted to the best advantage and with best results with an arsenic content of the mixture of 10 to 15 per cent., according to the flux selected, a speiss much richer in arsenic as produced by the smelting furnaces of Laurium at the present day offered, with essential lesser quantities of fluxes, no difficulty at all in the converter process. It even appeared that notable additions, especially of limestone, exerted an unfavorable influence upon the As content of the roasted product and the time of dearsenicization.

This speiss had the following average composition: Pb, 4.5 per cent.; As, 40 per cent.; Cu, 2.25 per cent.; Sb, 0.3 per cent.; Ni + Co, 0.7 per cent.; Ag, 80.2 oz. per ton. In such a complicated system of metal mixtures, conclusions cannot be drawn at once from the known behavior of the mixtures of single components of the system and, as I was not provided with the necessary apparatus to make thorough thermic investigations of the system to which these speisses belong, I can only make surmises regarding the behavior of the different mixtures.

It appears to me that beyond a certain percentage of As in speisses of otherwise equal composition their melting point grows higher, contrary to expectation. During the beginning of the blow As and Sb are oxidized; the heat liberated in consequence is not sufficient to produce the high melting temperature of the mass. (Nor do these speisses fuse as easily in the furnace as the ones rich reverberatory in Ni and Co and poor in As). If by losing about 20 per cent. As, the point of composition is reached at which, according to experience with the other speisses, the fusion would commence at an essentially lower temperature, then the individual speiss particles are in consequence of the loss of 20 per cent. in weight, which

[3]German Pat. 195,465, Kl. 40a, Gr. 2.

is distributed uniformly over the mass (just as in the case of the escape of CO_2 from limestone), separated so far that a union of the melted particles previous to the loss of all the As and subsequent solidification cannot take place; the mass must, therefore, remain porous and open to the passage of air. The roasted product forms also in this case a homogeneous, spongy, porous mass, while in blowing the speisses poor in arsenic, owing to imperfect mixture, frequently unchanged parts inside of the porous mass may be observed, which generally show a higher percentage of As.

Mechanical Condition Important

Possibly during the loss of the first 20 per cent. As part of the Fe has been oxidized already and acts on the remainder of the speiss in the sense above mentioned as a flux. As already stated, purely mechanical (intermolecular) incidents play an important part in the blast-roasting process of lead ores as well as, undoubtedly, in the dearsenicization processes. These deductions, probably published first in "Theoretical Considerations on Lead-Ore Roasting," have recently been confirmed by E. J. Kohlmeyer[4], as he says: "In general, the view of the mechanical effect of fluxes, of the separation of the lead particles to make them accessible to oxidation will have to be maintained." A contemporaneous chemical action of the ingredients among themselves in consequence of oxidation, or of the particles of the fluxes may, of course, frequently coöperate insofar as new compounds are formed, which influence the melting point of the mass and the procedure of the thermo-chemical reactions.

Without doubt, investigations on the influence of ferrites possibly formed in the course of the process would be of great interest after Kohlmeyer and Hilpert in their researches[5] have opened such numerous new perspectives for the better understanding of the importance of ferrites in metallurgical processes. The real foundations for these methods are unquestionably the thermo-chemical reactions which need, however, further clearing up. A previous determination of the melting points of speiss and the fluxes used for their mixtures and a close observation of the thermic phenomena taking place in the course of dearsenicization would, of course, afford important knowledge and practical hints for this new process which, for the present, like most of these processes, has engendered as many theoretical problems as solved.

If these lines should incite to new investigations on the subject treated by our splendidly equipped metallurgical institutions, their purpose would be well attained. By the dearsenicization process described, a means has been found to render the utilization of bothersome and heretofore worthless by-products economically possible. Even where the beneficiation by older processes was possible it will be signally cheaper by the new process. The advantages accruing from the abbreviation of the process, the supplanting of human labor by machinery and the production of a lumpy, instead of pulverulent roasted material so much more advantageous to the succeeding smelting process, cannot be overlooked.

[4] *Metallurgie*, 1910, Vol. VII, p. 294.

[5] "Ueber Calciumferrite;" *Metallurgie*, 1910, Vol. VII, p. 193.

Broken Hill Proprietary Company

According to the report of the Broken Hill Proprietary Company for the half year ended Nov. 30, 1910, dividend payments are continued at the rate of 25 per cent. per annum, besides 10 per cent. depreciation on the property being provided. This company has paid 3019 per cent. in dividends and bonuses since its formation in 1885, and still has a surplus equal to 153 per cent. of its capital stock. No mining operations were carried on in the period under review, but the mine is now in good shape to be reopened. Labor has again been scarce, and a general increase in wages had to be allowed.

The work of the new zinc-concentration plant is said to be excellent. Five of the furnaces in the spelter plant are complete, and the remaining five will soon be finished. A mechanical roaster is being pushed, and when complete, will enable all 10 furnaces to be placed in commission. During the six months 204,193 tons of tailings were put through the lead-concentration plant from which 6954 tons of lead concentrates were produced containing 50.72 per cent. lead and 26.4 oz. per ton silver; 16,155 tons of slimes, and the residue of 179,713 tons was sent to the zinc-concentration plant.

From this was produced 43,907 tons of zinc concentrates carrying 46.06 per cent. zinc, 6.3 per cent. lead, and 12.49 oz. silver. The new zinc plant has five flotation pans; with a total capacity of 2400 tons of tailings per day. During the year 3432 tons of sulphuric acid were manufactured, 1400 tons being made by roasting blende. Of this 2459 tons were used by the Broken Hill Proprietary Company, and 973 tons sold.

The residue from the zinc-distillation furnaces is sent back to the lead blast furnaces, and are said to give a good return. They carry about 9 per cent. lead and 25 oz. silver. In the lead-smelting department, the following material was put through the furnaces: Oxidized ores, including ores purchased, 10,994 tons; converted concentrates and slimes, 70,934 tons; sintered slimes, 8282 tons; residues from zinc-distillation plant, 1221 tons; drosses, 6450 tons; flue dust, 961 tons; total, 98,842 tons, producing 49,591 tons of bullion.

The regular roasting department treated 57,818 tons of material during the year, the Carmichael-Bradford plant, 18,325 tons. Both these plants will soon be superseded by Dwight-Lloyd machines.

Sloss-Sheffield Report

The Sloss-Sheffield Steel and Iron Company owns extensive coal and iron-ore lands in Alabama, besides operating coke ovens, blast furnaces and steel works. Its capital account shows $10,000,000 common stock, $6,700,000 preferred stock and $400,000 bonds. The report for the year ended Nov. 30, 1910, states that the gross sales and earnings were $5,020,177, a decrease of $1,377,784 from 1909. The income account for the year is as follows:

Profits on pig iron	$474,407
Profits on coal and coke	272,590
Rents, interest, etc	254,004
Total net earnings	$1,001,001
General expenses and taxes	$119,478
Interest on bonds	210,000
Dividends	844,000
Total payments	$1,173,478
Deficit	$172,477
Balance forward from 1909	3,279,522
Surplus, Dec. 31, 1910	$3,107,045

Charges deducted before ascertaining net earnings included allowances for depletion of coal and ore mines and 25c. per ton on pig iron for repairs and renewal of furnaces. Dividends paid included $469,000, or 7 per cent., on preferred, and $375,000, or 3¾ per cent., on common stock.

The president's report says: "We delivered during the fiscal year 120,000 tons less than in 1909, which caused us to add largely to the accumulated stock of iron in our furnace yards. Thee result of the year's business of the company was not satisfactory; but this was due not so much to the conditions of the trade as to the misfortune which overtook the company near the close of the last fiscal year, in the flooding of the two slopes of its Sloss ore mines. The output of these mines is now steadily increasing, and we hope before long to have the output up to normal. While the output has not as yet reached a nominal tonnage, we are receiving sufficient tonnage of this ore to reduce the cost of iron for January in the Birmingham furnaces over $1.50 per ton below the average cost of the first six months of the year. The working capital showed a decrease in the year of $446,000, which is due to decline in the market value of securities, the heavy expenditures necessitated by the flooding of the ore mines, the opening of the third iron-ore mine at Irondale, refitting Nos. 1 and 2 furnaces, and a deficit for the year of $172,000 after dividend payments."

Boston Consolidated Mill—II

By Claude T. Rice

All the first concentration was done by Wilfley tables. The tailings were classified and retreated on Wilfleys, Johnston tables and vanners. About 6000 gal. of water per min. used; recovery 71.7 per cent., at a cost of about 51.5c. per ton of ore.

The ratio of concentration in the Bingham copper ores depends mainly upon the amount of pyrite which accompanies the copper sulphides. This ratio varied in typical ores of the Boston Consolidated Copper Company from 19:1 to 20:1. The pulp from each six stamps went to a three-compartment classifier where it was separated into three products and an overflow. The overflow from the four classifiers in each unit went to two distributers, each of which fed six 8-ft. Callow cones, having a slope of 60 deg. A clear overflow was obtained from these 12 thickening cones, which was taken to a sump and then pumped back to the reservoir on the hill above the mill. The thickened underflow, which consisted almost entirely of particles that would pass a 200-mesh screen, went to the four lower tables on the Wilfley floor of each unit, but these tables did not make tailings, the pulp from them being retreated on vanners on the floor below.

The combined flow from the first spigots of the four classifiers in each unit went to six Wilfley tables, while the combined pulp from the second spigots went to a second group of six Wilfley tables and the combined flow from the last spigots went to a third group of six Wilfley tables. The 22 Wilfley tables were arranged in two rows of 11 each, heads to heads, the rows running lengthwise with the slope of the terrace. The driving pulleys and shafting were carried by a low structure springing from the mill foundation and of such hight that the longest belt drive was not over 12 ft. On this was mounted the two 30-h.p. motors, each of which drove a row of 11 tables. Each line of shafting was provided with a friction clutch. All the Wilfleys were of the No. 5 pattern.

Pulp Flows Through Tunnels

Under this structure were placed the pulp launders, so as not to shut off light from the tables, while the feed water for the tables was carried in pipes placed in the tunnels under the mill and was brought up to the tables by goose-neck extensions through the floor. The concentrates, middlings and tail products from the tables, as well as the slime waters, which, by the way, go to the vanners for retreatment, all dropped into different launders in the tunnel under the section. An accompanying illustration shows the arrangement of the Wilfley tables, which was unique in this mill. It also shows the manner of lighting, through gables over the center of each unit in the mill, and also the small amount of waste head room above the table floor, which in most mills is so large and in winter forms such a useless tax on the heating system.

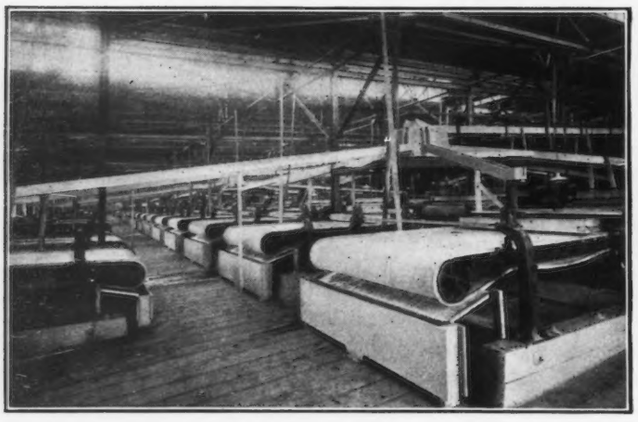
The accompanying sectional elevation of the mill also shows the low character of the mill building possible with this type of table arrangement, which results in a less expensive structure of the mill. Moreover, the use of the auxiliary structure for carrying the shafting gives greater safety to the oiler as he has a better chance to get at the bearings than is the case when the driving shaft is carried by the frame of the building.

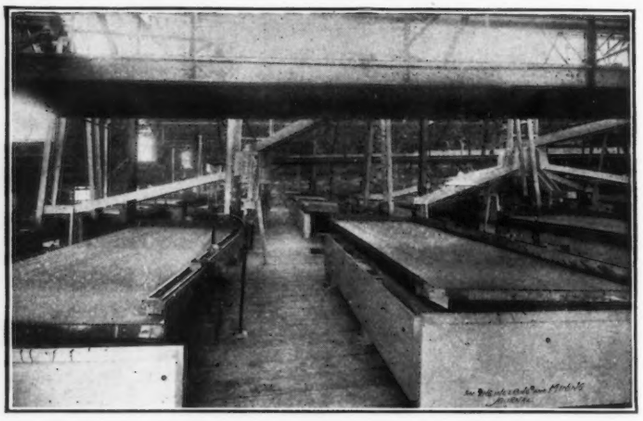
Close Classification the Basis of Close Saving

Screen analyses show the excellence of the classification accomplished in this mill. The pulp going to the first six tables contained 62.5 per cent. on a 50-mesh screen. In the pulp from the second spigot were the particles that ranged between 50-mesh and 200-mesh, the bulk of these staying on a 120-mesh screen. The pulp from the third spigot contained the heavier particles of the battery pulp that passed a 200-mesh screen, the lighter portion being in the settled product that went to the last four Wilfleys in a unit. It was mainly because of the close classification at this mill that a high saving was made, and also because the finer portion of the pulp was subjected to different types of concentrating action, first on the Wilfley tables, as this is adapted best to the saving of the larger particles and then on the vanners, which on account of the gentleness of their motion are adapted best to the saving of the smaller particles.

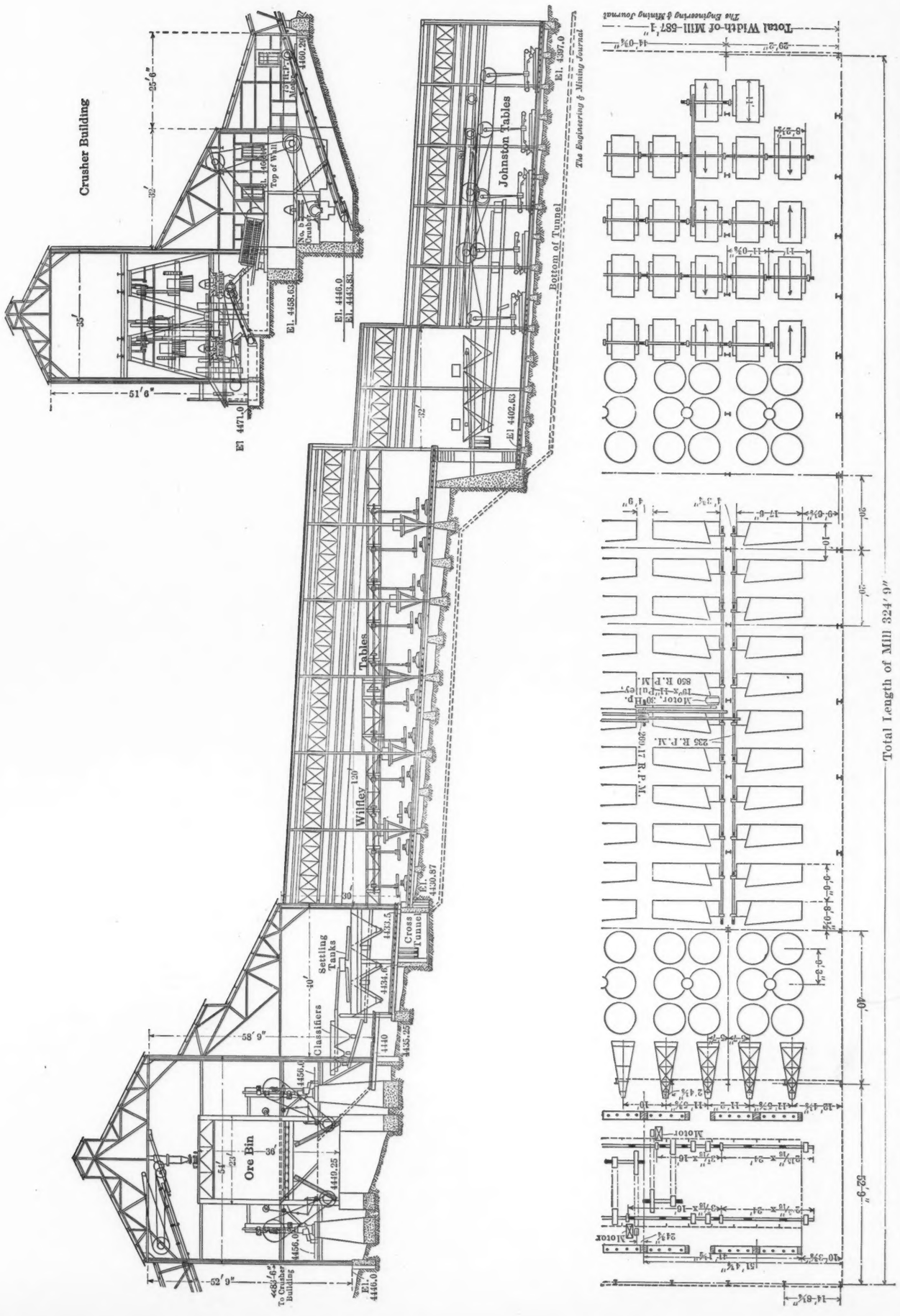
Advantages of Wilfleys Followed by Vanners

Moreover, by doing the bulk of the concentration on the Wilfley tables a richer and cleaner concentrate is obtained than if most of the concentrating be done on vanners. This is true even when the Wilfley table is treating a pulp that will pass a 150-mesh screen, for the Wilfley makes a middling product into which the finer sulphides can be thrown along with a considerable part of the silica, which, in the case of the vanner, would have to go into the heads rather than let the sulphide be lost. The cleaner the concentrates the less is the amount of the silica in them and the less the penalty at the smeltery. The silica is a detriment in the concentrates not merely on account of its being penalized by the smelter, but also because it increases the





Vanner and Wilfley Sections, Boston Consolidated Mill, Garfield, Utah



SECTIONAL ELEVATION AND PLAN OF ONE SECTION OF BOSTON CONSOLIDATED MILL.—NOW THE ARTHUR PLANT OF UTAH COPPER COMPANY, GARFIELD, UTAH

tonnage of concentrates that must be smelted to get the copper.

Tailings from First Wilfleys

Each of the first two groups of six tables made four products in its operation, viz., concentrates, slime water, middlings and tailings, the last of which in the first two groups of Wilfley tables went to waste, as these tailings averaged only 0.3 to 0.35 per cent. copper. The tailings from the first two groups of Wilfley tables amounted to about 55 to 57 per cent. of the total tailings made by the mill, and it was due to the low grade of these tailings that the mill was able to make a saving of about 70 per cent. on a 1.5 per cent. head.

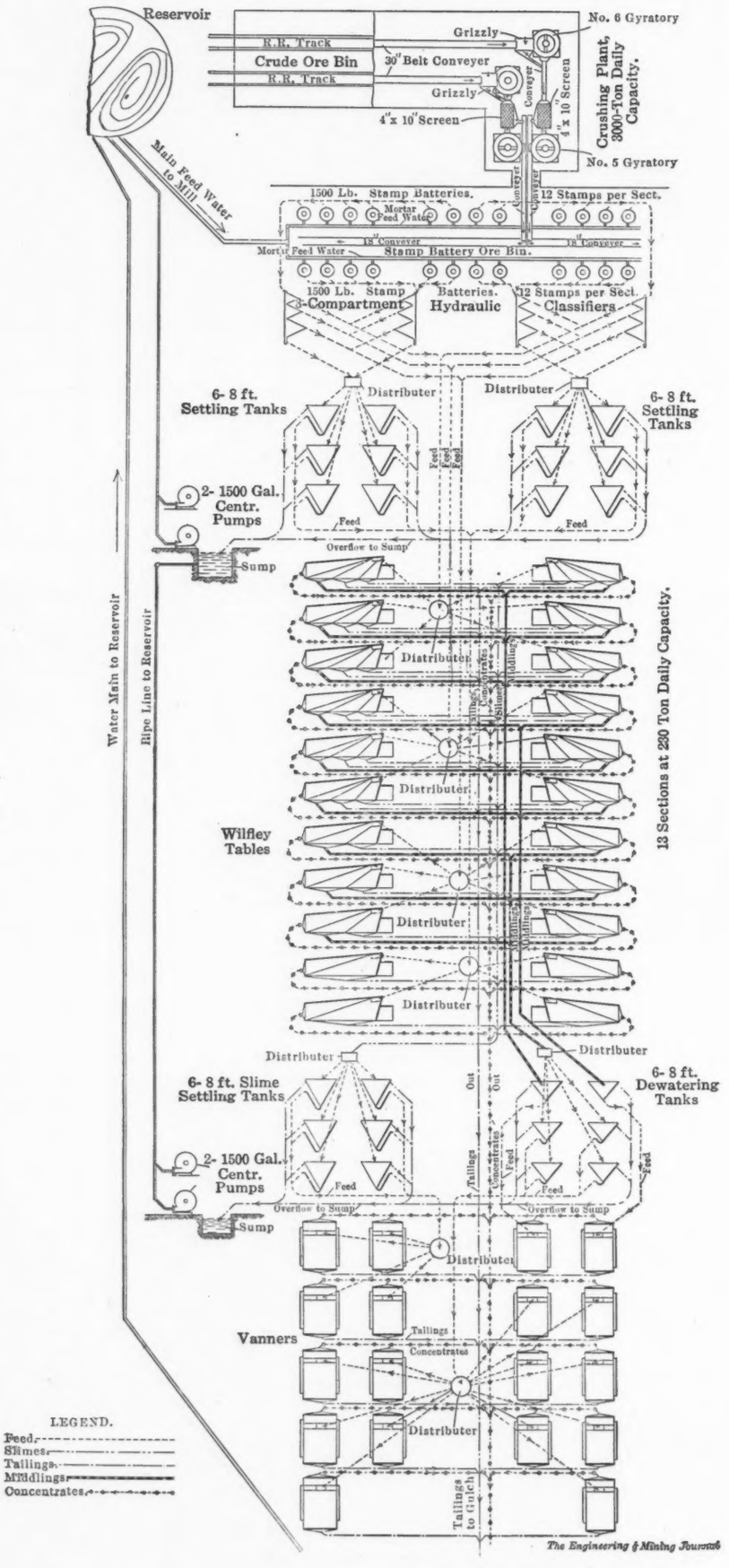
The middlings from the first two groups of six Wilfleys went to a hydraulic classifier on the vanner floor, which divided them into two sizes, the coarser of which was retreated on a Wilfley and the finer on a Johnston. The middlings from the last Wilfley went with the concentrates, while the Johnston and the Wilfley both made tailings. The slime waters from the tables went to this same classifier, which removed any sand that might be in them, and then the overflow went to six 8-ft. Callow cones, which fed the thickened product to two Johnston vanners.

The middlings from the third group of six Wilfley tables went to two 8-ft. Callow cones to be dewatered, and then the thickened underflow was treated on six Johnston tables. The tailings from the third group of six, together with the tailings and the middlings from the last group of four Wilfley tables, went to the four 8-ft. Callow cones and after being dewatered were treated on nine Johnston tables. All the Johnston tables made tailings.

Vanner Arrangement

The vanners were arranged in four main rows and one minor row, having four vanners to a section. The driving shafts for the vanners were placed so that the maximum length of drive was 12 ft. These vanners were driven in three units by two 40-h.p. and one 20-h.p. motors, each connected through a friction clutch with the driving shafts.

The necessity of placing the vanners so that they run with the slope of the terrace necessitated a shutting off of the overhead lighting to some extent, but not so much as in many mills. Still the arrangement of the feed launders was not so good as could have been obtained had a trunk-launder system of distributing the pulp among the different vanners been adopted. The vanners were set so as to have a slope of 2⅝ in. between centers of the main rollers. As the coarse grains of sulphide had been taken out on the Wilfley tables, smooth belts were used on the vanners. The Wilfley tables



FLOW-SHEET OF BOSTON CONSOLIDATED MILL

and the vanners were found to require about a third of a horsepower. The vanners were fitted with Shackelford conveyers for the concentrates. This conveyer consists of a notched piece of timber fastened by two arms to the vanner body. The notches are so turned that they move the concentrates forward toward the discharge hole in the concentrate box; as the notched piece returns it leaves the concentrates behind. The vanner boxes were not fitted with float valves; as there is but little water lost that way their use is not justified.

FILTER ON CONCENTRATE BINS NOT USED

The concentrates from the vanners and the Wilfley tables joined and were taken in one main launder to concrete settling bins near the railroad tracks below the mill. These concentrate bins were equipped with a filter bottom, but the vacuum pump was never ordered as the saving in moisture and the decrease in the freight for the short haul to the smelter was not enough to justify the extra cost. There were 10 of these flat-bottomed bins, each 16 ft. square and 10 ft. deep. The water overflowed from one tank to another and then was returned to the mill. After a tank had been filled the feed was shut off, and the tank allowed to drain for 15 hours. Then the concentrates were loaded into cars by means of a clam-shell bucket, operated by a track derrick tended by one man and a helper. The concentrates going to the smeltery contained 15 per cent. moisture, and assayed 20 to 25 per cent. copper, 20 to 25 of silica and 18 to 20 per cent. iron.

All the tailings went to a concrete launder that took them to a house where

TABLE OF COSTS AND OPERATING DATA, BOSTON CONSOLIDATED MILL—FEBRUARY, 1908, TO JANUARY, 1909

	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
Tons ore milled	9,307	7,857	14,800	15,576	21,187	21,567	24,625	28,365	33,767	44,378	35,537	44,355
Average heads	0.828	1.330	1.440	1.380	1.510	1.486	1.670	1.680	1.447	1.537	1.500	1.515
Average tails	0.270	0.440	0.460	0.435	0.460	0.470	0.500	0.480	0.417	0.435	0.410	0.430
Indic. extraction, per ct.	67.4	67.7	68	68.3	69.6	68.0	70.0	71.3	71.2	71.7	72.0	71.6
Actual extract., per cent.	70.0	70.8	70.7	70.9	71.3	70.3	71.9	73.1	72.9	71.9	72.0	.....
Tons concentrates	746	945	1,223	1,190	1,304	1,300	1564.5	1,659	1,981	2,192	2,122	2,250
Ratio of concentration	12.50	8.30	12.15	13.00	16.20	16.57	15.74	15.70	17.00	20.00	16.70	19.00
Assay of concentrate	6.22	7.39	11.80	12.30	17.50	17.39	19.00	18.94	17.64	18.38	19.00	18.84
Copper produced, lb.	99,880	139,862	288,628	292,740	456,400	452,140	594,510	629,413	727,199	824,943	776,086	855,000
Possible stamp hours	.....	44,352	51,840	60,840	69,120	68,160	71,424	87,552	110,592	138,240	136,416	155,520
Stamp hours run	.....	36,585	48,345	54,68o	66,275	58,764	67,836	78,415	102,775	129,765	108,524	134,228
Stamp hours lost	.....	7,767	3,495	5,795	2,845	9,396	3,588	9,137	7,817	8,475	27,892	21,292
Tons per stamp day	.....	5.15	7.35	6.83	7.70	8.80	8.71	8.68	7.89	8.21	7.20	7.77
Total cost mil'g per ton, c.	77.70	100.00	65.90	73.00	54.52	52.23	54.91	47.20	52.65	47.51	65.82	51.36
Detail Costs, Cents:												
Weighing	0.80	0.96	0.41	0.32	0.24	0.14	0.33	0.21	0.16	0.17	0.16	0.13
Unloading	.....	2.70	1.12	1.56	0.97	0.66	0.67	0.78	0.88	0.70	1.13	0.89
Crushing	7.50	8.60	4.31	3.70	2.79	3.24	2.62	3.45	3.77	4.61	6.86	4.58
Stamps	23.70	31.04	26.93	29.3	24.24	23.65	27.13	20.41	22.00	19.50	29.07	17.93
Callow tanks	1.90	2.20	1.25	1.60	1.39	1.36	1.49	1.33	1.31	1.02	1.30	1.07
Wilfleys	5.30	7.70	3.23	2.98	2.40	2.08	2.07	2.30	2.79	2.31	3.05	2.52
Vanners	5.30	6.57	2.94	3.11	2.21	2.43	2.22	2.64	4.87	4.44	4.07	4.55
Launders	1.40	1.70	0.88	0.93	0.93	0.74	0.99	0.64	0.66	0.49	0.65	0.55
Water	15.50	16.18	13.85	16.59	10.62	9.51	9.00	7.66	8.0	7.98	11.13	9.52
Concentrate bins	0.80	0.98	0.77	0.92	0.85	0.57	0.67	0.86	1.31	1.38	1.97	1.73
Heating	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.24
General (mill)	15.50	21.37	10.21	11.99	7.87	7.85	7.72	6.92	6.9	4.93	6.41	5.65
Total cost as above	77.70	100.00	65.90	73.00	54.52	52.23	54.91	47.20	52.65	47.51	65.82	51.36
*Power	32.20	38.18	22.0	20.3	14.8	13.46	13.75	13.1	14.0	12.8	15.3	12.95
*Screen cloth	.....	4.60	6.00	7.30	8.10	7.30	6.70	7.06	5.50	4.00	9.00	1.52
*Shoes and dies	.....	1.40	2.70	2.00	2.40	2.30	2.30	1.20	0.85	3.00	1.90	2.06

*Included in total milling cost per ton, but given as additional information.

TABLE OF COSTS AND OPERATING DATA, BOSTON CONSOLIDATED MILL—FEBRUARY, 1909, TO JANUARY, 1910

	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
Tons ore milled	31,000	53,101	59,783	63,988	64,589	66,245	72,000	72,000	67,515	69,795	70,740	80,845
Average heads	1.598	1.494	1.44	1.47	1.47	1.62	1.55	1.58	1.60	1.62	1.64	1.60
Average tails	0.440	0.443	0.43	0.425	0.445	0.498	0.498	0.505	0.508	0.512	0.54	0.545
Per cent. extraction	75.7	75.7	70.3	71.0	70.0	69.2	68.0	68.0	68.2	68.4	67.0	67.4
Tons concentrates	1,673	2,750	3,193	3,440	3,300	3,170	3,695	3,550	3,370	3,552	3,300	3,630
Ratio of concentration	18.0	19.3	18.7	18	19.0	20.9	19.4	20	20	19.6	21	22
Assay of concentrate	21.4	20.5	19.0	19.02	20.55	23.67	20.1	22.1	22.3	22.3	23.60	23.84
Copper produced, lb	750,429	1,127,500	1,222,340	1,361,960	1,356,720	1,474,214	1,485,200	1,589,000	1,511,000	1,584,200	1,557,600	1,745,200
Possible stamp hours	151,296	176,640	176,640	201,600	207,360	218,880	232,128	224,640	232,128	224,640	224,640	232,128
Stamp hours run	105,279	141,092	168,559	194,718	199,047	207,156	216,810	214,135	220,940	210,711	198,497	221,376
Stamp hours lost	46,017	35,548	8,081	6,882	8,313	11,724	15,318	10,505	11,188	13,929	26,143	10,752
Tons per stamp-day	7.07	9.03	8.5	7.89	7.79	7.67	7.97	8.07	7.33	7.95	8.55	8.76
Total cost per ton, c.	60.35	49.76	46.43	49.45	48.49	55.75	49.89	50.11	54.99	52.21	55.82	53.63
Detail Costs, Cents:												
Crude-ore bins	1.19	1.06	1.19	1.32	1.07	1.11	1.09	1.09	1.14	1.06	1.21	1.15
Crushers	4.67	3.17	2.65	3.98	4.05	4.53	4.82	4.49	4.49	5.16	6.21	5.16
Crushed-ore bins	.....	0.04	0.02	0.03	0.00	.....	0.01	0.00	.....	.....	0.21	0.68
Stamps	23.28	21.65	21.09	22.82	21.00	26.55	21.93	21.97	25.52	22.92	22.67	22.21
Wilfleys	3.14	2.31	2.12	2.34	2.72	2.86	2.95	2.45	2.83	2.75	2.51	2.49
Vanners	4.43	3.46	3.21	3.22	3.15	3.35	3.40	3.35	3.86	3.36	3.76	3.73
Launders	0.60	0.43	0.49	0.43	0.48	0.68	0.41	0.51	0.55	0.50	0.76	0.89
Callow tanks	1.11	0.84	0.89	1.09	1.09	1.22	1.11	1.01	1.18	1.10	1.13	1.06
Loading conc	0.80	0.86	0.79	0.52	0.54	0.66	0.62	0.44	0.65	0.49	0.63	0.88
Tailings dump	1.18	1.06	0.98	0.32	0.59	0.67	0.67	0.74	1.05	0.72	0,43	0.36
Water supply	9.69	7.10	7.00	7.64	8.42	8.28	7.48	7.50	7.64	7.84	8.38	8.09
Heating plant	2.89	0.55	0.11	.....	.....	.....	0.01	0.04	0.01	0.10	1.61	1.44
Mill expense	3.12	3.05	2.19	2.21	2.11	2.01	2.34	3.41	2.31	2.22	2.47	2.00
General expense	4.25	4.18	3.70	3.53	3.29	3.83	3.05	3.11	3.75	3.99	3.84	3.49
Total cost as above	60.35	49.76	46.43	49.45	48.49	55.75	49.89	50.11	54.99	52.21	55.82	53.63
Total power cost *	16.35	10.89	11.40	12.36	12.91	12.77	12.08	12.57	13.25	13.63	12.77	12.20
Screens*	0.70	0.53	0.73	1.27	0.96	1.31	0.85	0.97	1.20	0.60	0.98	1.77
Shoes and dies*	2.18	2.74	2.42	2.51	2.41	2.15	2.90	1.63	2.00	1.58	1.42	2.72

*Included in total milling cost per ton, but given as additional information.

they as well as the concentrates were sampled by means of a teeter-box sampler, the modification at the Boston mill being the hanging of the cutter from a track above the splash of the water so that in winter there was no danger of ice stopping the action of the sampler. The sample cutter had an opening ⅜ in. wide and a cut was taken every 20 min. The heads were sampled every 20 min. as the ore fell over the end of the tripper, but this head sample was not taken automatically. The cars were also sampled at the mine as they were loaded. These samples checked closely so that there was no doubt as to the accuracy of the head sample. Throughout the mill, dipper samples were taken to show the efficiency of the several steps in the treatment.

BOSTON CONSOLIDATED MILL—MONTHLY COST SHEET SUMMARY.

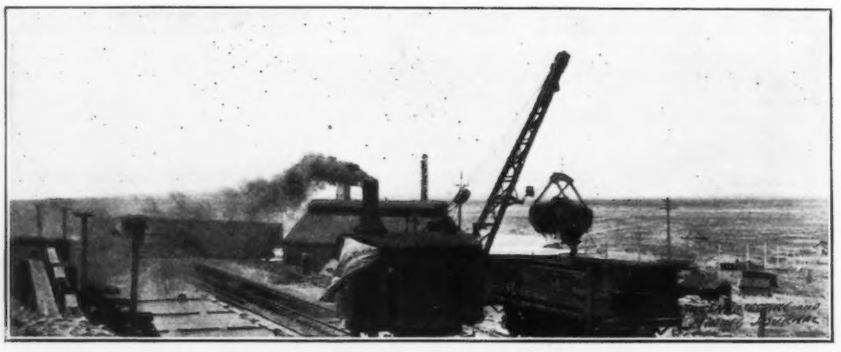
Operation	Amount This Month	Amount To Date, This Year	Month, January, 1910 Unit Cost in Cents per Ton Milled: This Month	Last Month	To Date, This Year	Last Year
Crude-ore bins	$931.57	$3,297.10	1.15c.	1.21c.	1.14c.	.....
Crushers	4,170.02	15,191.58	5.16	6.21	5.26	.....
Crushed-ore bins	553.70	708.15	0.68	0.21	0.25	.....
Stamps	17,950.53	67,220.30	22.21	22.67	23.27	.....
Wilfleys	2,010.50	7,619.87	2.49	2.51	2.64	.....
Vanners	3,015.27	10,623.76	3.73	3.76	3.68	.....
Launders	723.19	1,973.81	0.89	0.76	0.68	.....
Callow tanks	855.01	3,224.36	1.06	1.13	1.12	.....
Concentrate loading	712.96	1,949.99	0.88	0.63	0.68	.....
Tailings dump	294.35	1,805.05	0.36	0.43	0.62	.....
Water supply	6,541.16	23,097.57	8.09	8.38	7.99	.....
Heating plant	1,163.19	2,376.53	1.44	1.61	0.82	.....
Mill expense	1,613.82	6,465.54	2.00	2.47	2.24	.....
General expenses	2,821.39	10,858.42	3.49	3.84	3.76	.....
Total milling cost	$43,356.62	$156,411.93	53.63c.	55.82c.	54.15c.	51.47c.

Centrifugal Pumps Used

The pumping for the mill was done by three main centrifugal pumps. It consisted mainly in returning water, for as the pumps handled 6000 gal. per min. and only 500 gal. of this was new water, there was a recovery of more than 90 per cent. of the water used. Each pump was directly connected to an induction motor, supplied with a 2300-volt current. One 1600-gal. R. D. Woods four-stage pump and a 5000-gal. Bryon-Jackson three-stage pump returned 4500 gal. per min. from the tailings pond to the 1,500,000-gal. reservoir above the mill against a head of 380 ft. A small single-stage centrifugal pump returned the clear overflow from the concentrates bins to the mill sump, and a single-stage Byron-Jackson pump returned approximately 1500 gal. of water per minute from the mill sump, where the overflow from Callow cones also collected, to the reservoir against a head of 100 ft. The purchased water was added to the supply at the tailings-dam pumps.

Power Statistics

When the plant was treating about 2750 tons in 24 hours, 2625 h.p. were required to operate it. Of this 100 h.p. were used at the crusher house, 1250 h.p. to operate the stamps, 200 h.p. to run the Wilfley tables and the Johnston vanners, 900 h.p. to drive the tailings-pond pumps, and 150 h.p. to serve the other pumps. The current was supplied by the Telluride Power Company at 40,000 volts in a reinforced-concrete transformer house, placed between the crusher building and the main mill, where this power was stepped down. In this transformer house the different panels of the switchboard were arranged so that each controlled a different part of the mill. As each panel had its own voltmeter, ammeter and wattmeter it was possible to tell with accuracy the amount of power used by each part of the mill. The mill was equipped with a machine shop and a foundry, but these were run as separate institutions, and the cost of each piece of work was charged at cost to the department for which it was done.



LOADING THE BOSTON CONSOLIDATED CONCENTRATES

One Man per 17 Tons of Ore per Day

A total of 145 men was required in operating the mill during the three shifts. There were, on the three shifts: Three battery foremen, 12 battery feeders, nine battery repairmen on shift, 12 battery-feeder assistants, 12 battery helpers, six classifiermen, nine tablemen, four oilers, nine vannermen, three laundermen, three tankmen, one sampleman, three crusher foremen, 12 crushermen, six pumpmen, one floor washer, 14 battery repairmen, 16 general repairmen and 10 men unloading ore. This shows that more than 17 tons were milled per man when the mill was treating only 75,000 tons per month, but the same force of men was ample to operate the mill when it was treating 100,000 tons a month, as was the case after the Utah Copper Company acquired control and the mill was supplied with enough ore. Moreover, by simply adding rolls to the coarse-crushing department or another set of gyratories and the few men that would be required to operate them it would have been possible to treat in this mill close to 4500 tons a day. This should be remembered when studying the cost sheet that accompanies this article. If that were done, it is estimated that the milling cost, taking in every charge, would be not over 40c. per ton.

Explanation of the Cost Sheets

In explanation of the cost sheet it may be said that the different items cover all the cost that can possibly be charged to that department, and that there is no chance for suppression of figures, as is shown by some of the itemized accounts covering the main points in the cost sheet for January, 1910. The items, as to power, screen cloth, shoes and dies, given in one of the cost-data tables, are additional data that show, segregated from the rest, certain of the important variable costs. These items are all included in the charges shown in the upper part of the same table apportioned where they belong. Practically all the different items are self explanatory, but some confusion may arise from the fact that in one of the tables giving operating data, the account "crude-ore bins" covers the cost which in another table is covered in the two charges of weighing and unloading. The fiscal year with the Boston Consolidated Company began with October.

An interesting point in the cost statements is the charge covering the cost of heating the mill. This heating was done by means of hot air and a fan system to blow the heated air through pipes to the several parts of the mill building. The air was heated by sucking through steam coils heated by the exhaust steam from

the engines used to drive the blowers, and whatever other steam was necessary to raise the air to the proper temperature was added as live steam from the boilers.

A fair average for the tailings coming from the first two groups of Wilfley tables, when the mill was treating a head between 1.5 and 1.6 per cent. copper, was, as has been said, between 0.3 and 0.35 per cent. copper. The grade of the tailings from the tables treating the finer sand was about the same, while the tailings from the vanners handling the sandy part of the slime pulp averaged between 0.2 and 0.25 per cent. The great loss was in the treatment of the finest of the slimes, as the tailings from the slime vanners handling the finest pulp ran between 0.4 and 0.6 per cent. Consequently the average grade of the tailings was about 0.45 per cent. copper, as can be seen from looking at an accompanying table which shows that the monthly averages of the tailings from the whole plant varied from 0.27 per cent. in February, 1908, to 0.549 per cent. in January, 1910. The average of the tailings assays for the fiscal year beginning Oct. 1, 1908, was 0.449 per cent., while the extraction during that year was 71.7 per cent. on a head that assayed 1.518 per cent. copper. The total cost of the milling was about 51.5c. per ton, including every charge but depreciation of plant.

The cost of this mill was $1,250,000, and it had a capacity, without crowding, of 3300 tons per day. By the expenditure of a small amount to give additional capacity in the coarse-crushing department, the mill could easily have been brought up to over 4200 tons a day. These facts stand out in sharp contrast to the cost of erecting several of the other large concentrating mills of the country. The reason for this low cost of construction was mainly that the mill building was designed sensibly. The main building was low and the main shaftings were carried from structures springing from their own foundations and independent of the main building. Moreover, there was a large saving in belting. There was no great expenditure of money in special forms of machinery, and no royalties.

This article was originally written before the complete disintegration of the Boston mill had taken place, but owing to delays in printing, it now appears as an obituary, as a record of the past, and consequently in revising it the past tense has been substituted.

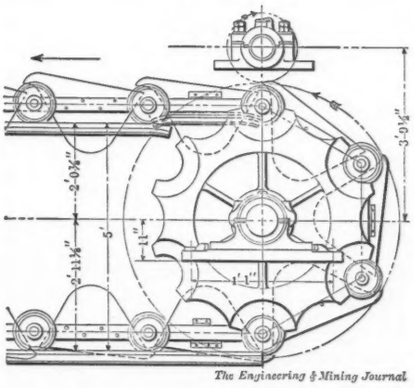
Before closing, I wish to call attention to a slight error in the middle column of p. 819 in the issue of April 22. Where reference was made to the size of opening in the trommels used in the coarse-crushing department, the diameter of the holes in the trommel should have read 1½ in. instead of ½ inch.

Ore Conveyer of Unusual Length

By John S. Watts*

The iron-ore conveyer, built by I. Matheson & Co., Ltd., of New Glasgow, Nova Scotia, for conveying ore from a storage bin on the shore of Annapolis basin to the pocket on the end of the wharf, whence it is delivered by a chute to the hold of a steamer, is of interest from its length. It is, I believe, the longest conveyer of the bucket type so far built in one length. The ore is mined at Torbrook and shipped by rail to Port Wade, a distance of about 50 miles.

The buckets travel on a practically level grade under the storage bin and along the wharf for 838 ft. and then run up a slope of 33½ deg. for 173 ft. to the top of the outer pocket into which they empty. There are 806 buckets, each of which will hold 1200 lb. of iron ore when full. The specified capacity of the conveyer is 2000 tons per hour, at a speed of 200 ft. per



Conveyer Bucket and Sprocket

min., which demands an average load of 833 lb. in each bucket.

The buckets, as shown in the accompanying illustration have an overhanging lip, which prevents any ore from falling between the buckets, and allows the buckets to be loaded by chutes without the intervention of any special filling arrangements. This figure also shows the driving sprocket. The conveyer is driven from the shore end, as the wharf was thought to be unable to carry the engines and boilers safely. The engines have a pinion on the crank shaft which meshes with the gear on the countershaft and the two pairs of gears reduce the speed from 185 r.p.m. at the engines to 13 r.p.m. at the sprockets.

The conveyer wheels are 12 in. in diameter and are lubricated by screw-down grease cups, the wheel having a groove cast around the bore to increase the amount of grease carried by each wheel, and thus allow a longer run than would be advisable with the small amount of grease that can be put in the small-size grease cup that the space at disposal will accommodate. When it is remembered that there are 1612 of these grease cups to be screwed off, filled and replaced, it will be seen that the lubrication of the machine is no small contract. The engines are two 14x18-in. on a common crank shaft, running at 185 r.p.m. and rated at 400 h.p., using steam at 125 lb. boiler pressure.

Some idea of the magnitude of this machine can be gained by the following figures. The 806 conveyer buckets with their links, axles and wheels weigh 342,000 lb., and when loaded the total weight to be moved is 742,000 lb., of which 69,000 lb. is on an incline of 33½ deg., being the weight of the ore in the buckets on the slope, the buckets themselves being balanced by those going down the slope.

At the outer end is a pair of massive take-up bearings, 6-in. bore. The reason for making the conveyer so long was to get out to deep water, and thus enable the ship to float at all stages of the tide, the tide at Port Wade rising 26 ft., and there is 26 ft. of water at low tide at the end of the wharf.

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Tin Mining in China

According to Leo A. Bergholz, U. S. consul-general at Canton, the tin mines of Kochiu extend over a large area. The ore is won through slopes usually at an angle of about 45 deg. Some of these slopes are over half a mile in length. Without exception they are very narrow and low, the largest one in the district being only 4 ft. high and a little over 3 ft. wide.

For miners, half-grown boys are in demand, as their small stature gives them an advantage in these narrow galleries. The ore is generally ferruginous and contains traces of lead. At the mouth of the mine it is dressed to a grade of about 60 per cent. tin. The smelting furnaces, of which there are about 30 in the district, are crude affairs. The blast is furnished by bellows of wood, each requiring three men to work it. Ten men in all are employed at a furnace. Charcoal is used for fuel.

Greek Mineral Production

The Greek government mining department has just published the following statistics of the minerals produced during 1909 and 1908:

	1909, Tons	1908, Tons
Iron ore	530,536	597,125
Zinc ore	44,656	28,739
Lead ore	234,531	.....
Magnesite	56,797	.....
Emery	8,193	7,471
Sulphur	55,922	.....
Chrome ore	9,600	4,350
Iron pyrites	14,738	6,867
Lignite	3,873	8,786
Manganese ore	5,374	10,750
Nickel ore	104	.....

The items are arranged in order of their 1909 monetary importance.

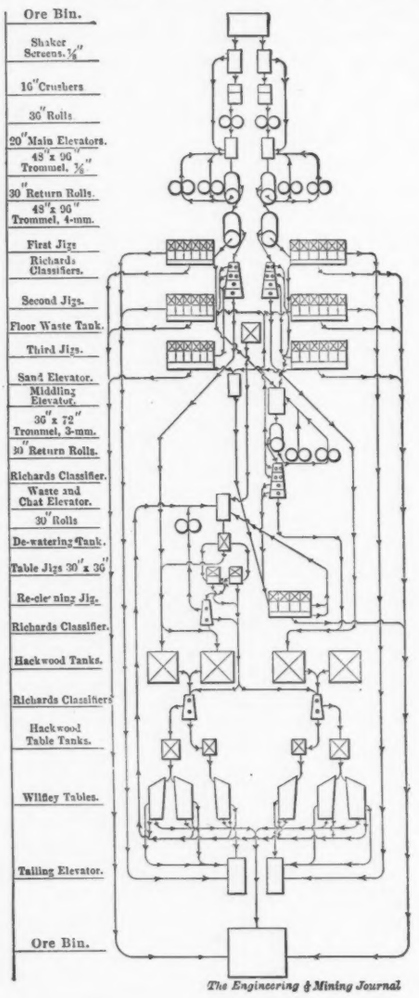
Concentration in the Joplin District

By J. H. Dietz*

To the newcomer in the Joplin mining district, be he the proverbial tenderfoot or an experienced operator from elsewhere, the concentration of Joplin ores presents some confusing problems. If he is planning the erection of a concentration plant and begins a study of existing plants as a basis for his own, he is soon involved in a thousand controversies. The wide diversity of ores in the Joplin district is not generally appreciated, even among the best engineers. This diversity is not great in physical appearance, and less in chemical analysis, but becomes evident in the finer details of concentration.

Take, for instance, the use of tables, which, until recently, has generally been considered unprofitable. Those who are using tables successfully for the recovery of fines will now tell you that tables will pay on any of this ore if they are properly handled, but this is not the case, and of the men who are using tables not more than 10 per cent. are getting the full value of their tables. Probably not more than 25 per cent. of the mills containing tables are dewatering the tailings from their roughing jigs and settling this water to feed their tables, the other 75 per cent. using at least a portion of this water, which may be rich in fine ore, to wash their tailings to the tailings elevators. Of the 25 per cent. not more than 5 per cent. are using adequate settling tanks for a thorough recovery. On the other hand, there are mines in this district in which the iron slimes easily, so that no matter how carefully the screening and settling of water is done, the resulting concentrate on the table will be so high in iron as to be unmarketable. No table has yet been used here that can successfully separate the iron and blende in sludge form, although vanners have not been tried.

Fine grinding is generally condemned, but in the majority of cases it is doubtful if proper provision was made for the recovery of the product after it was ground. It is probable that in the majority of the mills in this district fine grinding will not pay, but that it will pay in some cases has been demonstrated at the Gray Eagle mine, near Lincolnville. In this, as in nearly every other detail of milling, the operator must learn that what method he must adopt depends entirely upon the nature of his own ore. From this it would appear that the task of designing a mill to handle a given ore would be almost insurmountable, and that it has often proved so a glance over the district will demonstrate. Provision should always be made in financing a new mill to provide for careful experimenting to determine the best methods, and the mill design should be flexible and spouting arranged so that material may be handled in different ways. Progress in concentration has been slow in the district, because success or failure depends to so large an extent on the richness of the mine. Ore that runs 5 per cent. of blende will pay well with the crudest kind of milling, while ore that runs 2 per cent. will make a failure with the best. Frequently refinements in concentration are blamed for failures, due to the playing out of the mine, and the natural tendency here at least is to take the cream, if the mine is rich, and let large additional profits go through bad management and careless milling.



Zinc Mill Flow Sheet

Two new plants are now being built in the district that are departures from the southwest Missouri system of roughing and cleaning jigs and their success or failure will mean much to the future concentration of Joplin ores. One is the mill of the Hackett Mining Company, west of Joplin, and the other that being built by the Petersburg Land and Mining Company, near Quapaw, Okla. Both are using the sizing system, with careful saving of fines in large settling tanks, hydraulic classification, and large table capacity. The Hackett mill is using the new Richards jigs and pulsating classifiers, and the Petersburg mill an improved type of Cooley jig and Richards hydraulic classifiers. Both of these mills represent the best methods in mill design and construction, and it is greatly to be hoped that the richness of the ground on which they are located will make them financial successes, as that will do much toward better methods of concentration in the Joplin district, while failure of the mines will be a distinct setback to improved ideas of concentration on account of the inability of the average operator to differentiate the mining and milling processes in either failure or success. The flow sheet of the Petersburg Land and Mining Company's mill is given herewith.

*General manager, Eagle Foundry and Machine Company, Fort Scott, Kan.

Warrior Development Co.

The Warrior Development Company is operating the Black Warrior mine, near Miami, Ariz. The report of H. B. Hovland, president, recently issued, shows total receipts from Oct. 14, 1909, to Jan. 1, 1911, of $446,043, and disbursements (including $124,940 paid on property and $198,190 spent in operating Montgomery mine) were $415,915, leaving a balance on hand of $30,128. During the above period 31,450 tons of ore, dry weight, were produced at a cost of $6.4287 per ton, made up as follows: General expense, $0.4708; maintenance, $0.1870; mining, $4.4513; loading and shipping, $1.3196. The average copper content of ore mined was 9.6554 per cent. On a basis of 90 per cent. of assay the average price of copper received was 12.792c. per lb. From this must be deducted 2.5c. for freight, refining and selling, and 8.744c. for mining and smelting, leaving a net profit of 1.548c. per lb. of copper produced. The profit per ton, dry weight, of ore produced was $2.6895.

Active mining is now being conducted on the Warrior group, where the vein has been opened for a distance of 2500 ft. Underground openings total over 12,000 ft. The vein on this group is from 20 to 100 ft. wide and the ore so far mined has been mostly silicates and oxides of copper. Mining is being carried on between the 200 and 300 levels. The company plans to ship 125 tons of ore per day during 1911 and expects to resume churn-drill operations.

A recent patent (Brit. Pat. 14,023 of 1910) describes a direct method for the production of ammonia, by the passage of a mixture of hydrogen and nitrogen over finely divided osmium or uranium, or other similar catalytic material. The operation is conducted under about 100 atmospheres pressure, and the ammonia is separated from the uncombined gases by cold.

Coal Mining Department

The Important News Of Coal Mining: New Appliances, New Methods, New Fields, Colliery Engineering

Earthquakes and Mine Explosions

The probability of some connection between coal-mine explosions and periods of earth disturbances seems to be clearly indicated by a comparison of the dates of these events. In a paper read before the Western branch of the Canadian Mining Institute at its recent meeting at Nanaimo, B. C., F. Napier Denison presented the results of his extended investigations, stating that of the 114 colliery disasters, involving the loss of 3850 lives, that occurred in North America during the 11 years, 1900 to 1910, inclusive, 48 per cent. happened on the same day, or within 24 hours before or after an earthquake shock, as recorded by the seismograph at Victoria. Comparing nine disastrous explosions in Europe and South America, it was discovered that 77 per cent. of them occurred within 24 hours of a recorded earthquake. The year 1910 was notable alike for the frequency of the earth tremors and for the number of mine explosions.

Mr, Denison has devoted many years to the study of this problem, having charge of two official seismographs in Victoria, and has had for some time two others situated at the Western Fuel Company's mine at Nanaimo, one at the surface and the other at 1000 ft. underground. His investigations have attracted the attention of the late Lord Kelvin, and of Sir George Darwin, the latter of whom has actively assisted in the interpretation of Mr. Denison's results. It is hoped that continued study will reveal some means by which those conditions of the earth favorable to the occurrence of shocks, and consequently to the liberation of explosive gases in mines, can be prognosticated with sufficient certainty and previousness to enable official warnings to be issued to the managers of coal mines, so that they may institute extra precautions to avoid disasters.

In this connection it is interesting to note a discussion of the source of explosive gases in mines, by L. Morin, an abstract of which was printed in the JOURNAL of Sept. 17, 1910. According to this French engineer, the origin and the most important source of firedamp in a coal mine is to be found in adjoining coal seams, to which connection may be made by fissures through the intervening rock strata, produced by the unavoidable settling that accompanies the extraction of coal from an underlying seam. A sufficient number of fractures to permit rapid and unexpected inflow of gas might readily also be produced by an earthquake tremor of no very great amplitude, especially if this event should happen to coincide, as is not infrequently the case, with a period of unusually low barometric pressure.

As to the actual cause of mine explosions, Mr. Denison refers to the not thoroughly understood phenomena of earth magnetism and electricity. It is quite possible that the conditions that cause the phenomena known as electric storms, aurora, etc., may reach a culminating intensity at times of unrest in the earth; a fall of rock occurring then at just the right moment might perhaps produce a spark sufficient to ignite an accumulation of explosive mixture. Mr. Denison advocates strongly that further investigations of this important question be prosecuted.

Car Distribution Cases

WASHINGTON CORRESPONDENCE

The Interstate Commerce Commission has reopened the car distribution cases which were originally brought upon the complaint of the Hillsdale Coal and Coke Company; the Clark Brothers Coal Mining Company; and W. Jacoby & Co., against the Pennsylvania Railroad Company.

In the first opinion in the case, the commission ruled that discrimination had been practised against the coal companies but that it could not award reparation. The decision said: "The majority is still of the opinion that it is not for us under the law to assess and determine the measure of damages thus sustained by the complaint, that being a judicial question for the courts."

In reargument just presented to the commission a few day ago, and speaking of the interstate commerce act as it now stands the complainant's attorney said:

"The sweeping provisions of the third section covered every act which would subject any particular person, company, firm, corporation or locality, or any particular description of traffic to any undue or unreasonable prejudice or disadvantage in any respect whatsoever. It is important to keep this in mind when the question is under consideration, whether or not there has been done, or permitted to be done by the carrier any act or acts prohibited or declared to be unlawful, or whether any act or acts were omitted which the carrier was required by Act of Congress to do. The commission has found as a fact that the rule and regulation of the Pennsylvania Railroad, dated January 1, 1906, and in force at the time of the hearing for the distribution of its cars, was discriminatory, and did subject the complainant companies to undue and unreasonable prejudice and disadvantage as compared with other shippers. This being true the rules and regulations bearing dates respectively, Jan. 4, 1903, and March 29, 1905, must also have been discriminatory and have worked an undue and unreasonable prejudice and disadvantage to the complainants. We have then during the whole period of time covered by the complaints, to wit, from Oct. 1, 1903, to May 1, 1907, rules and regulations of the defendant company, discriminatory in the application and operation, and working undue and unreasonable disadvantage, in the distribution of cars as between the complainants and other shippers."

The attorney went further to examine the interstate commerce act to show that the commission is granted power to award reparation in such instance. He said:

"Thus it will be seen that the act of Congress not only grants the power, but imposes the duty on the commission to award reparation where the facts justify, and on refusal of the carrier to pay the amount awarded as damages on the order of the commission, sets forth in detail the remedy as contained in the sixteenth section of the act, which I have quoted. There is nothing in the language of the act that limits the power of the commission to award damages only when a rate has been found to be unjust and unreasonable."

The argument concluded with a summary of the losses which it was believed should be paid the complainants.

The commission has also heard reargument in the cases involving the rate on coke from the West Virginia and Pennsylvania ovens to Chicago. These complaints were brought by the Anaconda Copper Mining Company, and the Boston & Montana Consolidated Copper and Silver Mining Company.

During March over 96,000 acres of public land in Nevada and Utah were withdrawn from entry by the Government on the assumption that these lands contained coal. During the same month there were restored to entry in Western States, 1,951,021 acres of land previously withdrawn.

Government Coal Mine Experiment

By George S. Rice *

Plan of development and details concerning operation of the mine now being equipped by the Bureau of Mines to study mining problems and determine methods for the prevention of explosions.

NOTE—This paper was prepared for Western Society of Engineers by permission of the director of the Bureau of Mines.

*Chief engineer with Bureau of Mines, Pittsburg, Penn.

The explosibility of coal dust in air having been successfully demonstrated in the 100-ft. gallery of the U. S. Bureau of Mines, at Pittsburg, and in the longer galleries at Lievin, France, and Altofts, England, the next step in investigation of coal-dust explosions by each of the experiment stations was to determine the exact conditions under which such explosions took place. When these conditions were understood, tests of various preventive measures could be undertaken with some degree of precision. Prevention, or at least, limitation of explosions in mines was, of course, the real objective of the stations.

The gallery at Lievin, a short length of which was erected in 1908, was gradually lengthened to a distance of 820 ft.; at Altofts, also erected in 1908, the gallery was about 950 ft. long, as originally laid out. In both these galleries the limitations of strength prevent safe loading with pure coal dust for more than a distance of 400 to 500 ft.; on loading beyond this distance the galleries are somewhat ruptured. The managements of these stations have expressed the desirability of making tests of coal dust in longer and stronger galleries, since it is impossible to solve all the problems surrounding an explosive in the short distances now available; moreover, methods of limiting an explosion which were successful with a loading of coal dust for a length of 300 or 400 ft., would probably not be so with a longer loading or a larger explosion.

The director of the Bureau of Mines and his technical staff, at an early date appreciated these unavoidable limitations of the surface gallery, hence desired to obtain an underground gallery or mine opening, which would not only enable the tests to be made on a larger scale than is possible in external galleries, but in which experiments could be made under actual mining conditions. In such an underground gallery there would be no restriction as to the extent and violence resulting from explosion experiments, provided a suitable location was secured. Moreover, the methods of limiting and preventing explosions, the real objective of all such investigative work, could be tried out under real mining conditions.

The Greatest Difficulties

It was foreseen that the greatest difficulties in experimenting in an underground gallery would be:

(1) To obtain certain desired natural conditions.

(2) Having obtained these, to carry out and control the experiments in a scientific way, and be able to get complete records in the face of violent explosions.

After a long search a location for the experimental gallery, or mine, has been selected, near Bruceton, Penn. From 2500 to 3000 ft. of straight entry can be driven from the outcrop in the Pittsburg seam. In some of the mines operating in the seam, in the past, great explosions have occurred.

Conditions at Bruceton Mines

The entries will probably be either level or slightly rising, except for irregularities, so that there will be no serious problem of drainage. The entries lead into a steep sidehill and a cover of from 60 to 160 ft. is obtained. The openings are well located with reference to explosion effects, as there are no houses in the vicinity, except those in connection with the plant. The mine is fairly close to a railroad (one-third mile), so that the coal dug in advancing the entries can be loaded on railroad cars. By damming a ravine close at hand, water can be obtained for a boiler plant and fire protection. Natural gas for experimental purposes and for use in a gas incline engine and fan engine is obtained from a pipe line which passes a few hundred feet from the mouth of the mine. Finally, the situation is near enough to Pittsburg to allow convenient movement of the engineers and physicists between the testing station there and the mine. The situation of the mine is 12 miles southwest of Pittsburg, on the Wheeling division of the Baltimore & Ohio Railroad. The coal and necessary surface surrounding the mouth of the mine, have been obtained at a nominal rental from the Pittsburg Coal Company.

After a long continued search for the best location, which would give the desired conditions, the present site was picked, and about the middle of December permission was obtained from the Secretary of the Interior and the Director to proceed with the laying out of the mine. The surveys already having been made, the outcrop was uncovered and two parallel entries with 40 ft. of pillar between them, were started. At the time of writing this description (March, 1911), these entries have been driven in under cover over 200 ft. The right-hand one, which will be considered the main entry, was started in the lower part of the coal seam, taking the top of the limestone, which is 6 ft. below the coal seam, as a floor. Between the limestone and the coal seam there was at this point a hard shale; the entry was excavated in this and in 3 ft. of the lower part of the coal seam, leaving up for a roof about 2½ ft. of the main seam.

After going in about 50 ft. in this manner, the floor was gradually raised on an upgrade until the excavation was wholly in the coal seam and the draw slate above it. The so called "draw slate" is a soft shale or clay which comes down immediately on mining the coal Above it, as is generally the case in the Pittsburg seam in this district, there is 1½ to 2 ft. of so called "roof coal," which is generally of poor quality and interspersed with layers of shale.

The parallel entry, which will be called the air course, was driven wholly in the coal seam. It is not intended to use the mouth of this entry in explosion tests. For normal driving this air course will be the return, and ventilation will be obtained by a small fan driven by a gas engine, located at the top of a small upcast shaft near the mouth of the air course. The shaft will be offset from the air course about six feet.

Details of Layout

There will be another entrance to this air course joining at about 150 ft. from the mouth, and which will enter at an angle of about 55 deg., on the opposite side from the main entry. At the mouth of this side approach there will be placed a short length of concrete gallery with explosion doors, and beyond that a round steel gallery, 120 ft. long, 20 ft. of which will consist of removable sections that can be rolled out of the way when it is desired to isolate the 100-ft. gallery. This part will then be identical with the 100-ft. steel gallery at the Pittsburg station, with one exception, a branch off same a short distance from the inlet, to which a large reversible fan will be connected. The object of having this steel gallery, which is 6 ft. 4 in. diameter, separable from the mine, is that experiments similar to those conducted at Pittsburg can be made. The gallery at Pittsburg is so continuously occupied with the testing of explosives that systematic testing of coal dust cannot be undertaken in it.

When the removable sections before mentioned have been rolled to one side and a steel door lowered in place to cover the connection into the air course, experiments can be conducted in the isolated gallery without interfering with operations in the mine.

At the start it is intended that coal dust explosions shall be originated in the steel gallery and the explosion will enter the air course through the branch, pass up same to the last open crosscut, through the latter into the main entry and out to the mouth of same. The crosscuts will be driven on a circle tangent to the entries.

This will require one 45 deg. turn and one semicircular turn of the explosion wave, a condition which seems to cause no obstacle in a real mine explosion, nor does it cause difficulty in the Altofts gallery. The records of experiments in that gallery show that on the return side, that is, toward the exhaust fan, the dust, carried by the air current and the advance compression wave of the explosion, has been inflamed and the flame has passed around a number or all of the five right-angled turns in that gallery.

The purpose of this method of initiating explosions in the outside gallery of the experimental mine is to proceed from the known conditions in the gallery (as developed at the Pittsburg gallery) to the unknown conditions prevailing in mine entries. There is also another object, that while entries are being driven it will give double the length of travel for the explosive wave and thus allow the trying out of the mathematical instruments, before the final explosion experiments which may be originated in the interior of the mine.

Firedamp

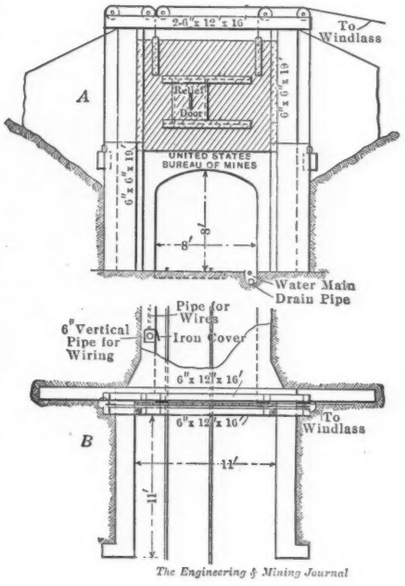
Besides making investigations of the explosibility of coal dust in pure air, it is intended to make tests with small percentages of methane in the air. It is generally recognized that a very light amount of methane, even as low as ½ per cent., may increase the chance of ignition of coal dust and more widely extend an explosion that has once been started.

The location of the experimental mine is fortunate in having a natural-gas pipe line near it. This line takes gas from some gas wells in the same ravine. It is intended to take a branch from this gas main for use in a gas-engine hoist and in a gas engine for driving a small ventilating fan. It will also be used for the purpose above indicated, of introducing when desired, small quantities of gas into the mine.

Natural gas has nearly the same composition as the marsh gas of the coal seams, the difference being that in addition to the methane (CH_4) there is from 10 to 15 per cent. of ethane (C_2H_6). This slightly varies the proportion of the mixture of air for its combustion, but the difference for practical purposes is negligible.

The gas will be piped to certain points and by a system of mixing with the ventilating current will be carried through in whatever proportions may be required; approximate percentages will be determined through meter measurements and precise determinations by sampling the air and gas mixture and analyzing. It is considered that this line of investigation of the effect of small percentages of methane is most important, and the need for it has been expressed by foreign critics of coal-dust experimentation now carried on.

It is anticipated that great explosive force will be developed at the mouth of the main gallery; hence it is intended that the timbering which is now in place must



Sketch *A* Shows Exit of Main Entry, While *B* is a Plan View of Exit at the Experimental Mine

be supported by reinforced-concrete walls and arching. The latter will present a smooth surface to the explosive wave and thus prevent great falls at the mouth of the mine, the occurrence of which would lead to heavy expense and delay in clearing up after each experiment.

It is the plan to concrete the approach leading from the steel gallery to the air course, and it may become necessary to concrete between this connection and the mouth of the air course, although it is not intended to load that portion of the air course with coal dust. It is expected that the explosion wave entering from the gallery entrance will not have gained sufficient momentum at the junction with the air course to break down doors or stoppings erected between that point and the mouth of the air course, but will be deflected into the air course toward the face.

Method of Driving Entries

The method of driving entries is the usual one employed in the Pittsburg coal seam. The coal is undercut and shot down with explosives, which in this case are of the "permissible" type, electrically fired. The coal is loaded on pit-cars, which are hauled by mules to the mouth of the mine, thence over an outside tramway with slight descending grade, to the head of a rope incline. Trips of cars are lowered, by hoist under brake, to a trestle and tipple located on a siding of the Baltimore & Ohio railroad.

It is necessary to have a considerable number of buildings; these are now under construction. There will be a boiler house with boiler to furnish steam for the several engines, including the fan engine. A crusher and grinder house will be necessary to grind up the dust for the experiments; as much as four tons will be necessary daily when the mine is developed.

There will be a blacksmith shop containing small equipment for the necessary repairs and an engine house for the incline engine. There will be a combined office and observation room; in connection with this observation room, there will be a small laboratory for field analyses of mine-air samples. Several small buildings, including a barn for the mules, have already been constructed.

The ventilating fan for the experiments must be of such size as to create all the conditions which may surround an explosion in a mine. It is desirable to obtain high velocity in restricted areas, say, 1500 ft. per minute over a considerable distance. A capacity of 80,000 cu.ft. per minute at a pressure of 2 in. water-gage and 15,000 cu.ft. per minute at a pressure of 6 in. water-gage is specified and has been guaranteed by the builder. The fan is made reversible so that experiments may be conducted with dust explosions going against the air current as well as dust explosions going with the air current. The Altofts gallery fan is not reversible and the explosion portion of the gallery is at the intake end.

Pressure and Recording Instruments

The important objectives of the experiments are to obtain the speed of the explosion, as indicated both by pressure and by flame; the variation in pressures at different points along the course of the explosion; the temperatures, and the samples of the gases immediately preceding the inflammation of the dust or gas and immediately following the inflammation at a given point. Such experiments will require apparatus of an extremely sensitive nature.

A similar set to those used in the Altofts' gallery have been purchased from the Cambridge Scientific Instrument Company, of England. These were de-

signed primarily for external galleries, but it is believed there will be no serious difficulty in arranging them in steel-plate boxes sunk into the coal rib. It may be found necessary to design new and additional apparatus.

An important point in the use of the recording instruments is their driving, also the making and breaking of electrical circuits. To connect these instruments with the outside will require the wiring to be done in such a way that it will not be torn out by the explosions. It is proposed to place the wiring in pipes placed in a groove in a coal rib and at the mouth of the mine; these pipes will be set in concrete, but arranged with suitable boxes at short distances apart so that the wires may be gotten at.

It is evident that to make the wires safe under the enormous pressures which are expected, which may run up several hundred pounds or more per square inch, will need great care. To obtain the currents for the instruments will require a very steady-running generator-engine set. It is expected to obtain a set which will be sufficiently large to allow some lighting with incandescent lamps in and around the mine.

The real importance of the experiments is not the mere study of explosion waves, although of great scientific interest, but to study methods for preventing or limiting explosions. It is, therefore, proposed to experiment with all the important methods that have been suggested up to date, as described in U. S. Geological Survey Bulletin 425, and the Bureau of Mines Circular No. 2, among which may be briefly recited, watering by water sprays, by exhaust steam sprays and by deliquescent salts (calcium chloride) and by rock and shale dust in various ways. It is believed these experiments tried out in a mine on a sufficiently large scale can effectually demonstrate the relative efficiency of the various methods.

A secondary purpose of the experimental mine, and by no means an unimportant one, is the study of explosives which have been placed in the permissible list for use in gaseous and dusty coal mines—testing them under actual working conditions in coal.

Dust Production

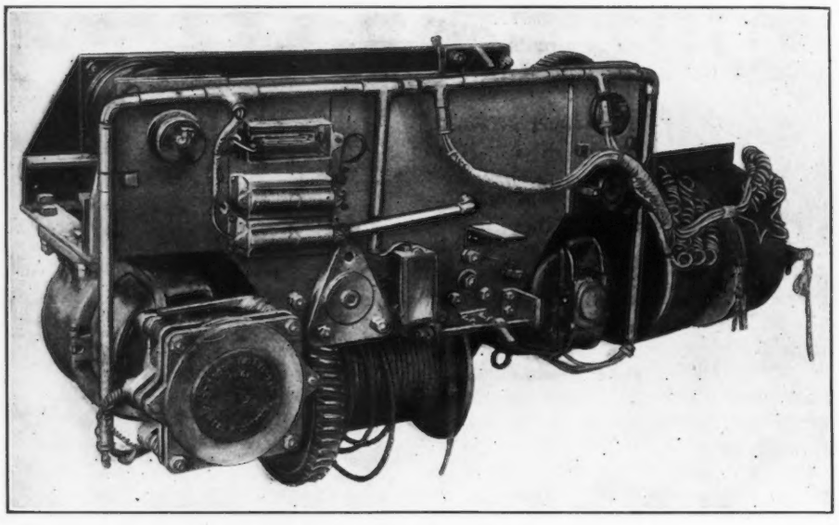
Another purpose to which the experimental mine can be put is in studying the relative production of inflammable dust by different types of machines which undercut or shear the coal. Still another purpose is the testing out, under mine conditions, of gasolene motors to determine the safety of the apparatus in actual use and the degree to which the air may be vitiated by the exhaust gases. It is probable that many electrical mining devices can be tried out under actual service together with tests of insulation of wiring.

The growing scarcity of mine timbers, as well as the danger of fire from their use, suggests the importance of testing reinforced concrete timbers and ties; also steel props and ties in the experimental mine. The relative advantages of brick arching and reinforced concrete for lining the main entries can also be studied, and under severe conditions. It is probable that the equipment will be sufficiently installed by May 1 to try some preliminary experiments. In the meantime the entries are being driven as fast as possible.

Electricity in Sinking Operations

By James A. Seager*

Engineers are now becoming accustomed to the application of electricity not only to the ordinary operations of the mine, but also to the constructional work in connection with the commencement of new undertakings, but an instance of its application at the Astley-Green colliery of the Clifton & Kearsley Coal Company, in England, is not without its special features of interest to mining men. The electric traveling winch shown in the accompanying illustration was used for the purpose of setting cast-iron tubbing into position around the mouth of a new pit shaft.



View of Electric Traveling Winch Used for Setting Tubbing in Shaft

The arrangement consisted of a circular track with a traveling crab, this crab being of a capacity of two tons and carried from a circular track 22 ft. in diameter, the rails being constructed of steel 12-in. by 6-in. section. It will be seen on the illustration that two motors are mounted on the crab, one for hoisting and the other for traveling. Both motors are of 1½-h.p. capacity and run at 460 r.p.m. The hoisting motor is geared so that the rope is given a speed of 5 ft. per min. when lifting a load of two tons, while the traveling motor propels the crab along the track at a speed of 100 ft. per min. when fully loaded.

Motor Controlled by Switch Gear

Each motor is controlled by a switch gear operated through hand ropes and the necessary fuses, etc., are, as will be seen from the illustration, mounted on the crab. There is an angle-iron collector bar by means of which current is derived, while the equipment further includes the necessary brake and overwinding arrangements and a steel-wire hoisting rope of sufficient length to give a lift of 12 ft., and an extension of 22 ft. when required. Moreover, the winding barrel is specially set to allow for a hook to be pulled outward a distance of 3 ft. from the vertical should this become necessary.

It will be seen from the above description that this is somewhat of a departure in electrical apparatus for colliery work; it is rendered more interesting by the fact that it was thought economical to go to the expense of buying from the Lancashire Dynamo and Motor Company, this special crab, in preference to relying on the older mechanical methods of placing tubbing in position.

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Coal in Batavia

The Belgian consul at Batavia reports that a committee has been formed for the purpose of investigating the question of the development of the coal industry of Ombilien. The Ombilien mines, which are owned and worked by the state, yielded over 400,000 tons of coal during 1909. The main object at present is to make up for the scarcity of labor by obtaining powerful electric cranes, capable of rapidly transporting large quantities of coal to the vessels which call at Padang.

Mining and Metallurgical Patents

A copy of the specifications of any of these patents issued by the United States Patent Office will be mailed by THE ENGINEERING AND MINING JOURNAL upon the receipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

A Classified List of New Inventions

COAL AND COKE

COKE—Coking and Gas-Generating Oven. Heinrich Koppers, Essen-on-the-Ruhr, Germany. (U. S. No. 985,909; Mar. 7, 1911.)

DUST—A New or Improved Machine or Apparatus for Distributing Dust in Coal Mines and Other Places. George S. Bragge, Midway, near Burton-on-Trent, Eng. (Brit. No. 12,360 of 1910.)

SAFETY LAMPS—Gauze of Miner's Safety Lamps. Ernest Arthur Hallwood, Morley, England. (U. S. No. 986,461; Mar. 14, 1911.)

SAFETY LAMPS—Improvements in or Relating to Miners' Safety Lamps and Operating Devices in Connection with Same. Ernest A. Hallwood, Leeds, Eng. (Brit. No. 6928 of 1910.)

SAFETY LAMPS—Miner's and the Like Electric Safety Lamp. Charles Victor Albert Eley and Thomas Patrick Brady, Birmingham, England. (U. S. No. 988,321; Apr. 4, 1911.)

SCREENING AND PICKING APPARATUS for Coal and Other Minerals. Joseph Dodds, Rutherglen, Glasgow, Scotland. (U. S. No. 988,255; Mar. 28, 1911.)

WASHING—Coal-Washing Jigger. Thomas H. O'Brien, Dawson, N. M. (U. S. No. 987,642; Mar. 21, 1911.)

COPPER

CONVERTER—Metallurgic Apparatus. William H. Peirce, Baltimore, Md., assignor to Peirce-Smith Converter Company. (U. S. No. 987,909; Mar. 28, 1911.)

PORPHYRY ORES—Process for the Recovery of Copper from Porphyry Ores and the Like. Georg Schneider, Lauenstein, Germany, assignor to Oscar Krauth, Charlottenburg, Prussia, Germany. (U. S. No. 986,508; Mar. 14, 1911.)

GOLD AND SILVER

AMALGAMATOR. Frederick J. Hoyt, Redlands, Cal. (U. S. No. 987,071; Mar. 14, 1911.)

AMALGAMATOR AND SEPARATOR. John T. Hogan, Denver, Colo. (U. S. No. 987,677; Mar. 21, 1911.)

ANTIMONIAL ORE TREATMENT—Treatment of Gold-Bearing Antimony Ores. John Jones and Horace Sandford Bohm, Shandon Hill, Mount Morgan, Queensland. (U. S. No. 984,090; Feb. 14, 1911.)

CONCENTRATOR AND AMALGAMATOR. Watson Marshall Nesbit and Edward Pike, Eureka, Utah. (U. S. No. 989,396; Apr. 11, 1911.)

CYANIDING—Improvements in and Relating to Apparatus for Separating Solids and Liquids. Wilbur A. Hendryx, Denver, Colo. (Brit. No. 12,471 of 1910.)

CYANIDING—Means for Separating Pulverized Ore or Other Comminuted Solid Matter from Liquid. Alexander John Arbuckle, Johannesburg, Transvaal. (U. S. No. 988,535; Apr. 4, 1911.)

FILTERING—Container for Pressure Filters. Charles W. Merrill, Alameda, Cal. (U. S. No. 987,904; Mar. 28, 1911.)

ORE TREATMENT—Apparatus for the Treatment of Ores and for the Electrolytic Deposition of Gold and Silver and Other Metals from Solutions Containing Said Metals. Frederick Capel Brown, Komata, New Zealand. (U. S. No. 987,428; Mar. 21, 1911.)

ORE TREATMENT—Method of Treating Ores Containing Tellurides of Gold. Thomas B. Crowe, Colorado Springs, Colo. (U. S. No. 987,964; Mar. 28, 1911.)

PLACER-MINING APPARATUS. Charles Finkbeiner, Denver, Colo. (U. S. No. 986,626; Mar. 14, 1911.)

IRON AND STEEL

BLAST-FURNACE DUST—Apparatus for Recovering Metal from Blast-Furnace Dust. Harry C. Parker, Ironton, Ohio. (U. S. No. 987,739; Mar. 28, 1911.)

CONVERTER. L. G. Woods, Pittsburg, Penn. (U. S. No. 986,534; Mar. 14, 1911.)

ELECTROLYTIC IRON—Process of Making Sulphuric Acid and Electrolytic Iron. Alexander S. Ramage, Detroit, Mich., assignor, by mesne assignments, to National Tube Company, Pittsburg, Penn. (U. S. No. 984,703; Feb. 21, 1911.)

ORE TREATMENT — Improvements in Means for Separating the Constituents of Certain Iron Ores. Francis I. du Pont, Wilmington, Del. (Brit. No. 17,609 of 1910.)

TITANIUM STEEL—Process of Treating Metallic Bodies. Auguste J. Rossi, New York, N. Y., assignor to the Titanium Alloy Manufacturing Company, New York, N. Y. (U. S. No. 986,504; Mar. 14, 1911.)

LEAD, ZINC AND OTHER METALS

NICKEL—Treatment of Sulphide Ores. James A. McLarty, Toronto, Ont., Canada. (U. S. No. 987,156; Mar. 21, 1911.)

TIN—Detinning and Degalvanizing Scrap. Alexander S. Ramage, Newark, N. J., assignor to John H. Maugham, trustee for A. S. Ramage, Everley M. Davis, and the firm of Maugham & Lee. (U. S. No. 983,931; Feb. 14, 1911.)

TITANIUM ALLOYS—Process for Producing Alloys of Titanium with Other Metals or the Like. Auguste J. Rossi, Niagara Falls, N. Y., assignor to the Titanium Alloy Manufacturing Company, New York, N. Y. (U. S. No. 986,505; Mar. 14, 1911.)

ZINC—Apparatus for Smelting Ores Yielding a Volatile Metal. Woolsey McA. Johnson, Hartford, Conn., assignor to Continuous Zinc Furnace Company, Hartford, Conn. (U. S. No. 13,208, reissue; Feb. 14, 1911.)

ZINC—Extraction of Oxide of Zinc from Complex Sulphide Ores. W. McCowan, London, Eng. (Brit. No. 3357 of 1910.)

NONMETALLIC MINERALS

ELATERITE—Process of Treating Elaterite. James C. Ross, Colorado Springs, Colo. (U. S. No. 984,240; Feb. 14, 1911.)

FELDSPAR—Method of Treating Rocks Containing Potassium. Allerton S. Cushman, Washington, D. C. (U. S. No. 987,436; Mar. 21, 1911.)

SULPHUR — Mining Sulphur. Herman Frasch, New York, N. Y., assignor to the Frasch Sulphur Process Company. (U. S. No. 988,995; April 11, 1911.)

MINING—GENERAL

BLASTING—Improvements in and Relating to Blasting and Mining Fuses. John Gillies, Braeside, Ont., and Claud D. McPhee, Arnprior, Ont. (Brit. No. 17,789 of 1910.)

DRILL—Rock Drill. Daniel Shaw Waugh, Denver, Colo., assignor to Denver Rock Drill and Machinery Company, Denver, Colo. (U. S. No. 984,171; Feb. 14, 1911.)

DRILLING — Drill-Dust Arrester and Air Purifier. William E. Dwyer, Leadville, Colo. (U. S. No. 983,986; Feb. 14, 1911.)

DRILLING—Dust-Arresting and Air-Purifying Device. William E. Dwyer, Leadville, Colo. (U. S. No. 983,882; Feb. 14, 1911.)

DRILLING—Improvements in and Relating to Water Supply Devices for Hammer Rock Drills. Heinrich Flottmann, Bochum, Germany. (Brit. No. 8648 of 1910.)

HOISTING—Safety Brake for Mine Cages. Charles Hansen, East Rand, Transvaal. (U. S. No. 988,568; Apr. 4, 1911.)

MINE CARS—Brake for Mine Cars. Thos. Stacey, Wilkesbarre, Penn. (U. S. No. 984,045; Feb. 14, 1911.)

MINE DOOR. Newton K. Bowman, North Lawrence, Ohio. (U. S. No. 988,622; Apr. 4, 1911.)

PROPS—Means for Propping Mines. Wilhelm Reinhard, Krefeld-on-the-Rhine, Germany. (U. S. No. 988,948; Apr. 4, 1911.)

TUNNELING MACHINES—Cutter Heads for Tunneling Machines. J. P. Karns Tunneling Machine Company, Boulder, Colo. (Brit. No. 12,590 of 1910.)

VENTILATION—Safety Device for Mines. Peter Darabos, Oakdale, Penn. (U. S. No. 984,355; Feb. 14, 1911.)

ORE DRESSING—GENERAL

CLASSIFIER—Ore Classifier. Frank G. Janney, Salt Lake City, Utah. (U. S. No. 984,222; Feb. 14, 1911.)

CONCENTRATION—Improvements in or Relating to Apparatus for Ore Concentration. T. J. Hoover, London, Eng. (Brit. No. 6896 of 1910.)

CONCENTRATING — Ore-Concentrating Table. Enos A. Wall, Salt Lake City, Utah. (U. S. No. 988,748; Apr. 4, 1911.)

CONCENTRATION — Ore Concentrator. Henry E. Wood, Denver, Colo. (U. S. No. 987,209; Mar. 21, 1911.)

CONCENTRATION—Process of and Apparatus for Concentrating Metalliferous Ores. Henry E. Wood, Denver, Colo. (U. S. No. 984,633; Feb. 21, 1911.)

CONCENTRATION—Process of Concentrating Sulphide Ores. W. M. Sanders, Marion, Ky. (U. S. No. 988,737; Apr. 4, 1911.)

CONVEYING AND COOLING APPARATUS—Ore-Cooling Apparatus. James Belcher Etherington, Winthrop, Mass., assignor to Campbell Magnetic Separating Company. (U. S. No. 986,813; Mar. 14, 1911.)

CRUSHING—Ore Crusher. Enos A. Wall, Salt Lake City, Utah. (U. S. No. 988,749; Apr. 4, 1911.)

CRUSHING—Roller Ore Crusher. Lamartine C. Trent, Reno, Ney. (U. S. No. 986,608; Mar. 14, 1911.)

SEPARATION—Improvements in or Relating to Magnetic Separators. Marcus Ruthenburg, London, Eng. (Brit. No. 21,031 of 1910.)

SEPARATION—Improvements in or Relating to the Separation of Ores or the Like. Mürex Magnetic Co., Ltd., and Alfred A. Lockwood, London, Eng. (Brit. No. 13,009 of 1910.)

SEPARATION—Improvements in the Selective Separation of Metals from Complex Ores or Products. Henry L. Sulman and Hugh K. Picard, London, Eng. (Brit. No. 8650 of 1910.)

SEPARATION—Magnetic Separator. Alvin Dings and Myron Dings, Milwaukee, Wis., assignors to Dings Electro-Magnetic Separator Company, Milwaukee, Wis. (U. S. No. 983,881; Feb. 14, 1911.)

WASTE ROCK—Apparatus for Disposal of Waste Rock from Concentrating Mills. Henry R. Wahl, Elvins, Mo. (U. S. No. 984,326; Feb. 14, 1911.)

METALLURGY—GENERAL

ELECTRIC FURNACE. C. A. Keller, Paris, France. (U. S. No. 986,179; Mar. 7, 1911.)

ELECTRIC-FURNACE PROCESS and Electric Furnace. Carl Hering, Philadelphia, Penn. (U. S. No. 988,936; Apr. 4, 1911.)

ELECTRIC FURNACES—Preheater and Reducer for Electric Smelting Furnaces. Alfred Stansfield, Montreal, Quebec, Canada, assignor of one-half to John W. Evans, Belleville, Canada. (U. S. No. 984,308; Feb. 14, 1911.)

ELECTROLYTIC EXTRACTION—Art of Electrolytically Extracting Metals from Their Ores. William D. Rennie, Hackensack, N. J., assignor to Universal Ore Reduction Company, Phœnix, Ariz. (U. S. No. 988,210; Mar. 28, 1911.)

EXTRACTION—Improvements in or Relating to the Extraction or Recovery of Metals from Ores and Other Materials. Marcus Ruthenburg, London, Eng. (Brit. No. 6601 of 1910.)

FUMES—Method of Treating Corrosive Gaseous Fumes or Smoke. Clarence B. Sprague, Salt Lake City, Utah, assignor to United States Smelting, Refining and Mining Company. (U. S. No. 984,498; Feb. 14, 1911.)

RABBLES—Improvements in and Connected with the Rabbles of Calcining Furnaces. Thomas Edwards, Ballarat, Victoria, Australia. (Brit. No. 23,429 of 1910.)

REFINING—Electrolytically Refining Alloys. Anson Gardner Betts, Troy, N. Y. (U. S. No. 987,947; Mar. 28, 1911.)

ROASTING—Furnaces for Calcining or Roasting Mineral Ores and Desulphurizing the Same. Thomas Edwards, Ballarat, Victoria, Australia. (Brit. No. 21,198 of 1910.)

ROASTING—Furnace for Roasting Ores. Nicholas L. Heinz, La Salle, Ill., and William H. Freeland, Isabella, Tenn. (U. S. No. 986,709; Mar. 14, 1911.)

Outlook in San Juan County, Colo.

By Walter C. Prosser*

The outlook for San Juan county for the season of 1911 is exceedingly promising. It is expected that fully 2000 men will be working in the camp by the first of July.

The Sunnyside mine is working 150 men and is milling 150 tons per day in the mill at Eureka. It is reported that the mill will be doubled, and will produce zinc concentrates and cyanide the tailings to recover the silver now being lost. Formerly a zinc concentrate was made but the zinc plant, destroyed by fire, has not yet been rebuilt. It is reported that ore reserves are blocked out for several years' operation. Joseph T. Terry is again in charge.

At the Gold King development has been carried on during the winter, and it is expected at any day that the mine will resume under full capacity of its 80 stamps. It is reported that the raise from the Gold King to the American Tunnels will be driven 538 ft. and that all operations of the mine will be carried on from Gladstone as soon as it is completed. The company has suffered loss of its mine buildings twice by fire and once last winter by snowslide. Bullion from the plates and heavy lead-iron concentrate were formerly produced. George Becker is in charge.

The Silver Ledge shaft has been sunk to 517 ft., and a lead-zinc ore has been opened up in the new sixth level. Arrangements are said to have been completed and new machinery is on the road to double the capacity of the mill, making it 150 tons per day. Present milling operations will be supplemented by jigging. Two products are made: Lead concentrates, 52 per cent. lead, and zinc concentrates, 45 per cent. zinc and over.

The Iowa-Tiger lease is producing 20 tons per day of lead concentrates and will probably continue throughout the year. New orebodies have been opened in the lower levels. The Mayflower mine will be connected to the Iowa mill by a short tramway and worked in conjunction with the other properties. It is reported to contain large bodies of lead-copper sulphide ore.

The Intersection property will operate under the leasing system for several months yet, producing gold bullion by amalgamation following stamps. The development is in free milling, at 200 ft. The oreshoots are reported to remain strong at this depth.

The Vermillion mill was last fall increased to 100 tons capacity per day. Development has been carried on during the winter and it is said that sufficient lead-copper-zinc sulphide ore of good grade has been opened up for a successful season's run. Two products are made in the mill; lead concentrate and zinc concentrate.

The Hamlet, which last season encountered its oreshoots of copper-lead sulphide ore in the sixth level just above the mill, is reported to be ready to resume active operation, producing copper-lead concentrate; present capacity, 70 tons. Etienne A. Ritter has been retained as consulting engineer.

At the Pride of the West a raise of 470 ft. is being driven on this property to connect the lower tunnel, which has its portal on the wagon road, to the upper workings, where it is reported a large tonnage can be taken out. The ore can then be delivered to wagons through the raise and hauled to the Green Mountain switch, a short distance below. The consolidation of this property with the Green Mountain is expected.

The properties, equipped with mills and reported to have good ore in sight and said to be completing or making arrangements for reopening at an early date are: Hercules, with 20 stamps, 100 tons capacity; Peerless San Juan, 80 tons capacity; Kittimac, 80 tons capacity; Silver Lake and Aspen, 300 tons capacity.

Properties which ship crude and have developed the ore during the winter and which will be operating as soon as the condition of trails and roads will permit, are: San Antonio, Congress, Kansas City, Queen City, Shenandoah and Dives, mining gray copper ore; Bullion King, No. 1 and Emma, mining argentiferous galena ores; Buffalo Boy, Slide, Summit, Little Maud and Esmeralda, mining highly silicious argentite ore; Big Bull lode, mining free gold; Kankakee and Gold Bug mines, at Bear Creek, mining telluride ore.

Other smaller properties that are reported will operate are: Venus group, at Gladstone; Standard Mining Company, in Giant basin; Detroit-Colorado, on Sultan mountain; Gold Mining Company; Senator Scotia group, at Eureka; Little Rea, on Boulder mountain; Columbus, at Animas forks and the Highland Mary in Cunningham gulch.

The Silverton Commercial Club is planning for the benefit of the mining industry in addition to the better freight and treatment rates, part of which have already been granted, the construction of a custom mill for the treatment of the ores of the prospector and small operator.

*Mining engineer, Silverton, Colo.

The Ott Mine Explosion

An explosion occurred in Ott mine No. 20 of the Davis Coal and Coke Company at Elk Garden, W. Va., April 24, with results disastrous to the mine, and probably to the men who were in it at the time. Particulars are lacking, and it has not been learned yet whether the explosion was caused by dust or gas. Officials of the company say they have never known the mines to be gaseous.

The rescue parties had not advanced far into the workings before they discovered it would take several days to dig through the heaps of roof coal and slate that had been loosened by the explosion. It then was decided to effect an entrance nearer the probable point of the explosion by cutting through the wall of an adjoining mine owned by the same company. Late in the afternoon the rescuers penetrated to No. 20 mine at a point about 4000 ft. from the outside entry. There still remained a considerable distance to go before reaching the buried miners.

Ott mine No. 20 is almost directly under the town of Elk Garden, which is on a hill. The mouth of the mine is about half a mile from the town.

The mine usually employs 200 men on the day shift and about the same number at night. A temporary suspension of work, however, required fewer men in the mines, else the casualties might have been greater. So far as known, there were only 23 men in the mine at the time of the explosion. The latest despatches report that eight bodies have been found, leaving 15 men still missing, but almost certainly dead.

Progress at Chino Mine

Hayden, Stone & Co., report on Chino as follows: "Chino has 45,000,000 tons of developed ore; it has been determined that 70 per cent. of this can be mined by steam shovel; the ore has been tested in an experimental plant, and a mill of 3000 tons capacity is being built."

"There are five steam shovels, one on the Hearst section, two in Romero, and two in the Whim Hill-Chino section. The shovels are moving 5000 tons of material daily. Most of this is stripping, as there is already an ore pile of 134,000 tons, in addition to the 250,000 tons of ore left in dumps by former owners. The shovels have exposed probably 2,000,000 tons, and in addition there is a large tonnage of ore practically at the surface in the Romero and Chino sections, which will be the first to supply the mill. There is no doubt that the mine will be able to supply ore to the mill with the greatest ease up to any desired amount as soon as the latter is ready to receive it; in fact, the mine could keep the mill as it is now being built well supplied with ore. At the mill the fine-ore bins are completed, the coarse-ore bins of 16,000 tons capacity are under way, the superstructure is up, and the cement flooring is being laid. The foundation of the power plant of 5000-h.p. capacity is built, and several of the boilers are in place. It looks as though the first section should be turned over early in the second half of this year."

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

B. B. Lawrence left New York this week on an extended trip to the West.

Blamey Stevens, who has been in New York, is going to Valdez, Alaska, for the season.

Edwin E. Chase, of Denver, Colo., has been at Kelly, N. M., on professional business.

W. Weston, of Denver, Colo., has gone to Guanajuato, Mexico, expecting to remain there about a month.

F. W. Hopkins, manager of the Mill and Smelter Engineering Company, of New York, has returned from an extended western trip.

William H. Schacht has been appointed assistant general manager of the Copper Range mines to relieve F. W. Denton of the detail work.

Herbert J. Stiebel has been appointed assistant to Roy H. Allen, manager of the Sierra Plata mine in the Minas Nuevas district, Mexico.

Lewis A. Parsons and John I. Kane have formed a partnership and opened offices as mining engineers in the Codes building, El Paso, Texas.

J. A. Farrell and W. R. Walker, of New York, have been chosen directors of the Edgar Zinc Company, to succeed F. I. Joy and W. E. Corey.

Dr. J. A. Holmes and George H. Rice, of the Bureau of Mines, have been in the Birmingham district, in Alabama, investigating the Banner mine explosion.

John Hopp returned to Barkerville, B. C., last month, from his home in Seattle, Wash., to begin the season's work on his four placer mines in the Cariboo district.

F. G. Mudgett, manager of the Horse Shoe and Diana mines, of Coulterville, Cal., has been appointed field representative and salesman for the Pierce amalgamator.

J. A. Burgess, formerly geologist for the Tonopah Mining Company, at Tonopah, Nev., has been appointed superintendent for the Nevada Wonder Mining Company, at Wonder, Nevada.

Hon. Richard McBride, minister of mines for British Columbia, in his capacity of premier of that Province, will shortly proceed to England to attend the coronation ceremonies in London.

Francis Church Lincoln leaves New York this week on an extended professional trip into the Northwest and British Columbia. His headquarters will be at Butte, Mont., during the summer.

R. T. White, general manager of the Balaklala Consolidated Copper Company, has resigned that position in order to become general manager of the Braden Copper Company, at Rancagua, Chile.

William H. Sayre, of the American Abrasive Metals Company, of New York, and part owner of the Sayre Mining and Manufacturing Company, spent several days recently looking over the property of the latter company in the Birmingham district in Alabama.

Leslie Hill, of Nelson, B. C., managing director of the Head Syndicate Ltd., accompanied by F. R. S. Balfour, Sir Edward Tennant, and Marlborough Pryor, has been making an examination of the syndicate coal lands on the South fork of Old Man river, Alberta.

James Hillhouse, late chief inspector of Alabama, has gone to Baltimore for an operation for an illness due to hard work and exposure in the Banner mines after the disaster of April 8. Mr. Hillhouse is 65 years of age and has followed the mining business since he was a boy.

Paul W. Gaebelein, of New York, formerly with the Golden Cycle Milling Company, of Colorado Springs, Colo., has accepted a position as consulting engineer for the Colorado Metals Extraction Company, of Denver. He will be assistant to Dr. W. L. Bain, at the Denver testing plant.

Charles H. Nesbitt, resident manager of the Sloss-Sheffield Steel and Iron Company for several years, has been appointed chief State mine inspector of Alabama by Governor O'Neal under the new mining bill. Six associate inspectors are to be appointed. Mr. Nesbitt is 38 years of age and experienced in the mining work.

J. C. Adams, for a number of years superintendent of the Boston & Montana properties, has been appointed assistant general superintendent of the Anaconda Company, and with B. H. Dunshee, will have charge of operations under Superintendent John Gillie. Mr. Adams will have charge of all of the mines on the south side of the hill, while Mr. Dunshee will continue to superintend the working of the hill mines at Butte.

OBITUARY

Frank Fletcher, for a number of years engaged in Mexico, died recently in southern California, where he had gone for his health.

Thos. L. Chadbourne for a number of years counsel for the Calumet & Hecla Mining Company and until recently a director of the Ahmeek Copper Company, died suddenly at this winter home at West Palm Beach, Fla., April 18. Mr. Chadbourne was a graduate of Harvard in 1862; he went to the Lake Superior district shortly after, was admitted to the bar in 1864, and continued his practice until recently when the firm of Chadbourne & Rees was dissolved and he retired from active legal practice.

Joseph Martin, of Terre Haute, Ind., died at St. Petersburg, Fla., April 9. He was one of the oldest coal operators in the Indiana field. Many years ago he was a miner. Later he became an officer of the Parke Coal Company, which developed the field at Rosedale. In the early days Martin was pugnacious, but when a struggle was ended, either with an individual at the mine, or in a wage conference between operators and miners, he was the first to restore friendly personal relations. It was "Joe" Martin who talked to the miners during wage conferences, in blunt and often violent terms, making it necessary for his brother operators to placate the miners. Martin, however, always had the respect of the workers and never forgot his early efforts as a miner.

SOCIETIES and TECHNICAL SCHOOLS

Rocky Mountain Club of New York—On May 9 the Club will give a dinner in honor of John Hays Hammond.

American Society of Mechanical Engineers—The local committee has outlined the arrangements for the meeting to be held at Pittsburg, May 30-June 2. There will be four sessions for the reading of papers and discussion, and visits to a number of plants in and near Pittsburg.

Iron and Steel Institute of Great Britain—The annual meeting of the institute will be held in London, May 11 and 12. The Bessemer gold medal for 1911 will be presented to Professor Henry Le Chatelier. The Andrew Carnegie gold medal for 1910 will be presented to Félix Robin, Paris.

Utah Society of Engineers—The annual dinner was held at the Commercial Club, Salt Lake City, April 20. Addresses were made by President John Dern, of the American Mining Congress, and by various members of the society. The following officers were elected to serve for the year 1911-1912; President, M. D. Grosh; first vice-president, C. F. Moore; second vice-president, E. H. Beckstrand; secretary, R. B. Ketchum; treasurer, A. S. Peters.

American Mining Congress—Recently at a special meeting of the members of the Mining Congress, the by-laws were amended to provide for a directorate of 13 members instead of nine, as heretofore. The four new members selected were Dr. James Douglas, New York; George W. E. Dorsey, Salt Lake City; B. F. Bush, Baltimore; Carl Scholz, Chicago. The directors have decided upon Oct. 23 to 28, both inclusive, as the time for holding the fourteenth annual session in Chicago. Charles M. Moderwell, president of the United Coal Company, Fisher building, Chicago, has been elected chairman of the local executive committee on arrangements.

Editorial Correspondence

Reports from our own Representatives on Important Events from Many Important Mining Centers of the World

Salt Lake City

April 24—An estimate of the output of Bingham for the three months ended March 31 indicates that the production for the first quarter 1911 was slightly less than the average during 1910. This is due in part to the snow and the inability of leasers and small producers to ship, also to the curtailment of the Utah Copper, which during January and February was operating at about 57 per cent. of its normal capacity. One section of the remodeled Arthur plant was put in commission the middle of March, while the remaining sections were being overhauled. No definite figures have been made public by the Utah Copper as to the amount of ore treated, but it is estimated that between 12,000 and 13,000 tons per day were shipped to the mills at Garfield. Besides this, the ore which came out of Carr Fork is estimated as follows: The Bingham-New Haven produced approximately 200 tons per day; the Highland Boy, 400 tons; the Utah Apex, 50 tons; intermittent shipments from the Bingham-New England, and ore produced by leasers on the Last Chance and former Boston Consolidated sulphide mine would make possibly another 100 tons per day from this side of the camp. The Yampa curtailed production early in the year, and produced probably in the neighborhood of 250 tons per day for the quarter. This makes a total estimated production for Carr Fork, exclusive of the Utah Copper work on that side, of 1000 tons per day.

For the remainder of the camp, including Upper Bingham, and the mines on the east slope near Lark the production is estimated to have been 1875 tons per day, divided as follows. The U. S. Mining Company properties, including the Old Jordan, Galena and Telegraph produced enough zinc ore to supply the Huff electrostatic plant at Midvale operating two shifts, and the Midvale lead furnaces in part. The output of these properties for the quarter has been 625 tons a day composed of lead, zinc and copper ores. In addition to this, the Utah Leasing Company working at the Telegraph mine is cyaniding about 30 tons of silicious gold-silver ore daily. There are also leasers at the Storey and other properties in Upper Bingham. The Ohio Copper has been milling between 1200 and 1300 tons of ore daily, which is sent out through the Mascotte tunnel to the mill at Lark. At the Commercial mine controlled by the Bingham Mines Company connections had not been completed between the Niagara tunnel and the Commercial workings, so little or no ore was produced by this property. The Bingham Mines Company's Dalton & Lark and Brooklyn mines have been sending out probably 50 tons daily, with some shipments to the Winemucca mill from a dump at the mouth of the Mascotte tunnel. The Fortuna mine on the Salt Lake Valley slope has not been operating, but leasers have made some shipments from the Congor property adjoining, now part of the Bingham Amalgamated. The production for this section of the camp is estimated to have been 1875 tons of ore daily.

Taking the Utah Copper shipments at 12,000 tons, the output of Carr Fork at 1000 tons, and the above figures for the remainder of the camp, the total estimated production for the first quarter of 1911 was 14,875 tons daily, as compared to 16,000 tons, which has been estimated as the average daily production during 1910. This would be 446,250 tons a month, or 1,338,750 tons for the quarter.

Denver

April 23—The Van Tilborg bill passed the senate on second reading. Recently the Chamber of Commerce protested to the legislature against the passage of any measure that would entail a heavier burden of taxation on mining properties. Mining men are not all opposed to additional taxation if they can organize along coöperation lines in the establishment of drainage districts that will insure greater development. The bone of contention in the Van Tilborg bill seems to be that some provision should be made to exempt from all other taxation if they are brought into a drainage district. It will be enough to assess mine valuation for construction of drainage without other State and county tax. Senator Van Tilborg does not desire a measure to go on the statute books under his name if its operation will cripple the owners of nonproducers; but, the active operators of the State are almost a unit for some kind of legislation that will enable them to organize mine-drainage districts.

It is persistently rumored that there is a negotiation for the purchase of the Revenue Tunnel Mines Company by the Camp Bird. The ore reserve in the Montana vein could forcibly appeal to the Camp Bird. It is well equipped to handle this ore while it is stated that the old mill belonging to the Revenue company is not making what is considered a good saving by mill men.

A ruling by Judge Lewis, of the Federal Court, which may allow the Government to recover damages for old coal frauds is far reaching and will establish an important precedent. It may effect coal lands obtained back as far as 40 years. The question to be decided is whether the Government has a right to recover damages from original procurers of coal land, alleged to have been fraudulently secured, after the land has been sold to others, without seeking to affect the titles of the parties who purchased it by cancelation of the original patents.

Pres. Frank A. Schirmer, of the Newhouse Tunnel Company, at Idaho Springs, has announced a general reduction of air, transportation and service rates. The reduction is 20c. per ton on ores valued at $6 per ton or less and a flat reduction of 50 per cent. on compressed air. This is most gratifying to the low-grade operators and assures a larger tonnage for the tunnel proper. The company also contemplates building a mill to treat custom ore that will handle all the ore from its tunnel.

Duluth

April 24—Rough estimates of the total amount that will be carried down the Lakes this season run from 25,000,000 to 40,000,000 tons. It is firmly believed here that there are good-sized stocks of ore carried over from last season, in storage in Lake Erie ports. The quantity is in doubt. If such is the case, the controlling factor, as regards the season's output is the improvement which may take place in the steel business. As this is entirely problematical there seems to be little possibility of determining, even roughly, beforehand to how great an extent ore will be shipped from the Minnesota and Michigan ranges this summer.

While no ore has gone down the Lakes as yet, the season has, in reality, opened. Reports from Escanaba are to the effect that the ore-hauling season has started on the Escanaba & Lake Superior road. By the time the boats arrive at the docks, there will be a supply in the pockets of the docks.

On the Mesabi, the Laura mine was the first to ship over the Great Northern. Next in order came the Stevenson, the Elizabeth, the Mahoning and the Croxton. This ore is going direct to dock. The Duluth, Missabe & Northern started to ship April 12, from the Buffalo & Sus-

quehanna mine, near Mitchell. This ore is not being sent to dock as yet, but is being held at Proctor. At the northeast end of the Mesabi, shipping began in the vicinity of Eveleth, April 18.

The Vermilion range, this summer, will probably show greater tonnage than for some time past. This is due to the Section 30 mine, which enters its first season as a large producer. It is understood that this mine has a contract for 200,000 tons for this summer. Owing to the high quality of the Vermilion ore, any possible curtailment in iron-ore production will probably be noticed last on this range.

Indianapolis

April 24—One of the largest coal-mining deals ever consumated in Indiana was closed during the last week. The deal includes all the properties of the Alliance Coal Company, formerly the coal holdings of John R. Walsh, and while the name of the purchasing company and the price were withheld, it is understood that the Vandalia Coal Mining Company is the purchaser and the expenditure considerably in excess of $1,000,000.

A. M. Ogle, Jr., of Indianapolis, son of A. M. Ogle, president of the Vandalia company, has gone to Terre Haute and taken personal charge of the general offices of the Alliance company. The plan is to remove the offices from Indianapolis to Terre Haute, and John H. Hewitt will be continued as general superintendent.

The transaction gives the Vandalia Coal Company control of the largest number of mines of any concern in the State. Until the deal was made, the company operated 12 mines with an average daily output of 10,000 tons. It also owned three mines which had temporarily suspended operation. To this property now has been added the mines of the Alliance Coal Company, 29 mines all told. The combined output aggregates 18,000 tons of coal daily. The purchaser likewise acquires 20,000 acres of coal land.

This deal marks the final step in the John R. Walsh enterprise. The property acquired involve mines and lands in Vigo, Sullivan, Clay and Greene counties, along the right-of-way of the Southern Indiana railroad. The Vandalia mines employ 3000 miners and the Alliance about 2500. It is conjectured that the Pensylvania Railroad Company will eventually come into possession of the Southern Indiana railroad, and is interested in this mammoth coal deal.

Cobalt

April 24—In the annual report of A. A. Cole, mining engineer for the Temiskaming & Northern Ontario railway commission, it is stated that the ore reserves of Cobalt mines are now larger than ever before, and that the present rate of production could be maintained for two years, without the discovery of a single additional orebody. In former years the practice at many of the mines, was to take out the ore as soon as found, meantime disregarding development. This method of working was responsible for many setbacks, but gradually better practice has prevailed, and now the majority of the mines are on a better basis than heretofore. The aggregate value of the ore reserves of the camp is placed at $30,000,000.

For some time past, Charles Butters and Professor Clevenger, of the University of California, have been conducting experiments, with a view to discovering the most economical method of treating the ores of the Nipissing and La Rose mines. So far only high-grade ores have been treated, and the results were very satisfactory, as shown by the production by the Nipissing of 307,670 oz. of bullion. A modification of this process, which consists in part of amalgamation and cyaniding, is being sought; whereby the lower-grade ores can be treated economically, and a high percentage of extraction assured.

During the last week there has been a general exodus from Porcupine of those who wished to get out before the break up. The roads are practically impassable, and, although people will be able to get in, by the summer route, in a short time, it is anticipated that the district will have a quiet period, until the completion of the railroad. The work of opening up the properties will, however, proceed more rapidly as, with the disappearance of the snow, prospecting for new orebodies can be carried on to better advantage.

London

April 12—During March the British public was asked to contribute over £31,000,000 to 17 different companies. Only five of these issues with a nominal capital of £362,000 were to be applied for mining purposes. The mining issues for the first quarter of 1911 were 27, with a capital of £4,816,000 as compared with the subscribed capital of £2,862,200 for 1910.

The Broomassie mine is one of the oldest of the Gold Coast companies and recently held its meeting. The chairman in his opening statement said, "In the further sinking of the shaft below the 620-ft. level, it was decided, in place of 100 ft. vertical, as formerly, to make the intervals between the levels 150 ft. vertical, or 180 ft. on the dip of the reef. We broke away therefore at 770 ft. vertical, and in the crosscut from the shaft to the formation at this level we fortunately encountered the top of a shoot of pay ore. To show how accidental these occurrences are, I may say that had we made the level at 720 ft. in place of 770 ft. we should have been above the whole of the three pay shoots of ore found in the 770 ft. level, and the drive which would necessarily have been extremely costly, would have been entirely unproductive." A few mining engineers can give cases of such fortunate accidents; but most engineers can give instances of unfortunate accidents. The oreshoots are variable both in width and value, varying from 9 to 137 in. in width and from 3 to 72 dwt. in gold. The shaft has been equipped with steel sets, and a new record for shaft sinking on the Gold Coast has been established. The 20-stamp mill was not operated in October, 1909, on account of no reserves. The working expenses during 1908 were 33s. 11d. per ton milled. The mill capacity is now being increased from 2500 to 3500 tons per month by the addition of grinding pans. In addition to the mine, the company has an interest in 16 miles of dredging concessions on the Ankroba and Marisi rivers.

The Great Chaffinch, a prospect in Westralia, which adjoins the celebrated Bullfinch Proprietary, has again been brought into notice by the Westralian government bringing a charge for "alleged conspiracy" against three mining engineers who stated that the reef had been "salted." After hearing the prosecution the magistrate dismissed the case. He said that he did not believe the mine had been salted, but considered that the accused honestly thought otherwise. It does Westralian mining infinite injury, as recently £125,000 was subscribed for this prospect.

Within a comparatively recent period England was one of the principal copper-producing countries; today the output is worth less than £30,000. At the time of the Reform bill a few of the leading adventurers in copper mines waited on Sir Robert Peel praying that the duties might be left as they were. The two decades following were prosperous years, but since 1870 the mines have nearly all suspended, not on account of the copper from other countries being admitted duty free, but because the lodes have been exhausted or too poor to work. An attempt is now being made to resuscitate an old copper mine in Cheshire, and a prospectus has been issued asking for £55,000 to rework the Alderley Edge mine, abandoned more than 30 years since. The prospectus reads well, especially as regards reserves and profits; the reserve is estimated at well over 8,000,000 tons, allowing one-third of this for faults, pillars, loss in working, etc., there remains in round figures 5,250,000 tons. "The returns, without taking into account the ore contained in the two vertical lodes, and lower grade orebodies, are estimated at £7,350,000, which after allowing for working costs should return a profit of at least £3,675,000." The ore is said to be a blue and green carbonate in three beds, with an average thickness of 4½ ft. each. The purchase price is £35,000.

The Mining News

Reports of New Enterprises. New Machinery. Installations. Development Work and Property Transfers. The Current History of Mining

Alaska

Chauncey Williams, formerly manager of the Big Hurrah quartz mine at Nome, is opening up galena claims on Steamboat mountain, and representatives of Fairbanks operators are preparing to install a 20-stamp mill on a free-gold group. A wagon road is being built from Hope, and as soon as this is completed, machinery will be taken in.

Shamrock—The property has been sold to H. E. Ellis and Charles G. Ganty, both of Valdez, who are planning development.

Matanuska—This gold property will be equipped with a 5-stamp mill. The property is on Archangel creek. James W. Hamilton, Knik, superintendent.

Alaska-United—The March returns show: Crushing, 28,513 tons; yield, $67,953; net profit, $13,033. The ore sent to the two mills averaged $2.09 and $2.68 per ton.

Alaska Mexican—For the month ended March 15 the mill crushed 15,739 tons yielding $49,227. The net profit was $14,761; yield per ton $3.12.

Hubbard-Elliott Copper Company—A. J. Elliott, secretary, writes: "We expect to send our engineer, with miners and supplies, to Alaska some time in May to open our properties on a large scale and also to determine the proper transportation of our ore from Elliott Junction on the main line of the Copper River & Northwestern, to our mines on Elliott creek. It is the intention of the company, if possible, to be in position to ship ore early in 1912. We have much development already accomplished." The company has 84 claims in the Elliott Creek district, and controlling stock in the Knights Island Consolidated Copper Company, of Alaska. It was organized to consolidate the properties of the Hubbard-Elliott Copper Mines Development Company and the U. G. I. properties and to build the proposed nine-mile tramway to the railroad. J. G. Sleever is president. The capital of the new company is $3,000,000; general offices, 265 La Salle street, Chicago.

Arizona

Cochise County

It is reported that the Denn-Arizona and the Shattuck-Arizona companies at Bisbee are planning a consolidation. The reported basis is 2 or 2½ shares of Denn for one of Shattuck.

Gila County

Miami—The company is employing 467 men, 180 in the mine, 210 on surface, 77 on construction. Two sections of the concentrator are operating and handling 500 tons each, or 150 tons more than the original estimate. Section No. 1, the third section to begin operation, will start soon. Section No. 4 will begin in May. Extraction thus far this month has averaged 75 per cent., and from the behavior of the mill the management feels certain that its original estimate of 80 per cent. extraction will be reached soon. Concentrates are being shipped regularly at the rate of one 50-ton car daily.

Warrior—This company is doing development in the western underground portion of its property and may install a churn drill in the near future. The mine continues to ship about 125 tons daily to El Paso. The ore averages slightly under 10 per cent. copper.

Inspiration—Until the generator and other equipment arrive the present rate of development will not be altered. A wagon road to connect the proposed concentrator, near Wheatfields, with the county highway is being graded, but it has not yet been definitely announced where the mill will be built. The allusion to partially developed ore in General Manager Drummond's recent report has led to some confusion. A block of ground is said to be developed when its four corners, 200 ft. apart, have been drilled. Where the 200-ft. parallelogram has not been drilled at all the corners it is said to be partially developed. Churn-drill hole 501 is in ore at 575 ft. No. 903 is 675 ft. deep and has been in ore for 135 feet.

Superior & Boston—The existence of a zone of secondary enrichment in the Arizona-Commercial below the 1000-ft. level will result in exploration for similar ore in this adjoining mine.

Arizona Commercial—As soon as the work of installation of another pump on the 1000-ft. station of the Eureka shaft is completed sinking will be continued until the 1200-ft. level has been reached. On the 1000-ft. level the crosscut north from the station will be continued. It should encounter the vein within another 50 ft. of drifting, at the point where the diamond drill recently passed through a body of 16 per cent. copper ore.

Keystone—A new electric hoist, other surface equipment of modern manufacture, and an aërial tramway to convey the ore to the Miami mill, are the more important of the improvements contemplated by the management.

Old Dominion—The first electric locomotive was installed recently and has proved satisfactory. The Kingdon electric hoist is in operation and with two other hoists is driven by power from the mixed pressure turbines recently installed.

Santa Cruz County

R. R. R.—This copper mine started work again two months ago and is now shipping. The new strike from which this ore comes is 12 ft. wide and is supposed to be the downward extension of an oreshoot formerly worked. R. R. Richardson, of Patagonia, is the owner.

Alto—This mine closed in 1907 has reopened with 10 men as a starter. F. J. Hobson with a long experience in the southwest and Mexico is in charge as manager. S. A. Fisher is in charge of the mining work. After cleaning up the company will ship ore from the old payshoot for the present, but expects soon to begin development to justify the plans for a concentrating mill. The mine has a record of $70,000 of ore in the first four months of 1907.

Anaconda—This mine in the Temporal district has obtained its new pump and has resumed sinking. It is financed by Kansas City money. The shaft is down 200 ft. and it is hoped to sink at least to 500 ft. B. F. Lindsley is in charge.

Ivanhoe—This mine, James Johnson, superintendent, is shipping ore two cars a month. The ore carries a silver running in carloads about $75 per ton. Considerable exploration is being done on the 200-ft. level.

Wynette—This shaft being sunk by T. M. Heck is making a good showing at the first level. The ore is about 3 ft. wide and assays about $25 per ton. Shipments will be made shortly.

Glove—This is the principal claim on the new strike made by the Sheehy brothers. The ore on one of the veins at the bottom of the main shaft runs 40 per cent. zinc and 20 per cent. lead, and will probably be shipped east. Further work is now being done. The orebody averages 4 ft. The other veins on which no deep work has been as yet done produce carbonate lead ores assaying 45 to

50 per cent. lead and 12 to 20 oz. silver. Eight-horse teams are hauling this to the new line at Amado. The mine itself is on the limestone-eruptive contact on the west side of Baya cañon about five miles southwest of Mt. Hopkins. About five thousand tons of the carbonate ore are now in sight.

Gold Ledge—This claim, owned by Josiah Bond, shows at the new work about 18 ft. of quartz carrying about $6 in gold to the ton. The group has been examined by a prospective purchaser.

Mansfield—Work is being done at this mine preparatory to sinking further at the Black Cap shaft. Some other shaft work is now being done on the Ruby claim further up the Mansfield cañon.

Gold Hill—This gold mine, near Mount Hopkins in the upper Caliente cañon, is being overhauled by the owner, J. F. Orosco, of Tubac and is to be examined by the representative of New York buyers.

YUMA COUNTY

Yuma—This copper company, C. C. Douglas president, floated largely in Boston, the stock having sold up to $2 or $3 at the time of flotation, has failed to develop ore either by shaft or diamond drill. Its stockholders refuse to pay an assessment, it is reported and the property will probably be purchased by one of the owners and liquidated.

Clara Consolidated—The company has elected the following board of directors: George Mitchell, Alfred Quetu, Robert E. Morrison, G. B. Nuytten, A. A. Sander, Oscar Fanyan, O. W. Strodthoff, W. B. Taylor and E. D. Elson. Announcement is made that smelting operations will be resumed during May, and that mine work is now in progress and that the company is in good financial condition.

California

ELDORADO COUNTY

Ribbon Rock—A good body of ore has been encountered at the 100-ft. level in this mine, near Eldorado. Upon the completion of the new hoist the shaft will be deepened to 500 ft. H. A. Harper, superintendent.

Alpine—A mill-run of ore from this mine, near Georgetown, has been shipped to Sacramento. If the test is satisfactory a Beers mill will be installed.

Monte—This mine, in Gold Hill district, has been bonded to the Echo Gold Mining Company, a new organization of Sacramento capital.

INYO COUNTY

Cerro Gordo—Zinc ore of high grade is being extracted from this former producer of lead-silver, near Keeler. Present work is confined to the 400-ft. level. L. D. Gordon, Salt Lake, Utah, is leaser.

Sam Kee—Twelve feet of shipping ore is reported to have been uncovered in this mine, near Keeler; chiefly lead and silver, with some gold.

KERN COUNTY

Lakeville—Suit has been instituted against this company for an account by Parker Barrett and others, who allege that the gusher has produced 8,000,000 bbl. of oil and is still producing 5000 bbl. a day, while the royalties received have not been commensurate with the output through failure of the defendant to provide proper storage, and failure to make statement of production. Plaintiffs claim 200,000 bbl. royalty.

LOS ANGELES COUNTY

Pittsburg Petroleum—This company has reopened the old field at Santa Susana, leasing a tract of land from the Simi Land and water company, on which are six producing wells that have been idle for about 20 years, and which are said to have produced 36 gravity oil. These wells have been cleaned and put on the pump, producing 15 to 75 bbl. a day each, which is contracted to the Los Angeles Refining Company. A pipeline is being laid to connect with the Southern Pacific Railroad. J. D. Krepps, Los Angeles, manager.

NEVADA COUNTY

Union Hill—This mine, at Grass Valley, is being unwatered; the concrete foundations for the 20-stamp mill have been laid, and the mill which is being built by the Nevada City Miners Foundry is nearly completed.

PLUMAS COUNTY

Crescent—The tailings from this quartz mine, at Crescent, and from the Green Mountain mill will be worked by cyanidation by the Mother Lode Mining and Reduction Company; Samuel Allschuster, San Francisco, manager.

Engels—Twenty men are engaged on the installation of the reduction works at this copper mine in Lights cañon, near Keddie. Henry Engels, San Francisco, one of the owners, is manager.

Canton—This placer mining company has applied for patent to four claims on north fork of Feather river, the application being contested by the U. S. Forest Service, on the ground that the applicants are seeking title for the purpose of water power. A water filing has been made on 150,000 in. at a point on this group of claims by W. S. Cone, reputed to represent the Great Western Power Company. The hearing will be held before a deputy commissioner of the Land Office, at Quincy, May 23.

SAN BERNARDINO COUNTY

Carbonate King—A purchase option on this group of claims in Clark district has been secured by J. Allen Veatch. The price is $60,000.

California Gold and Copper Company—The electro-chemical plant at the mine at Vontrigger, is completed, and in operation.

SHASTA COUNTY

Texas—This group of producing quartz claims in Old Diggings district, has been bonded to parties represented by George Bayha, of Redding.

Mammoth—The monthly average of ore treated at Kennett is said to continue constant, and the reserve to equal the quantity treated. The production is about 2,000,000 pounds.

Uncle Sam—The new 10-stamp mill on this mine, near Kennett, is in operation; 20 men are employed in the mine and mill.

TUOLUMNE COUNTY

Dutch—This mine, at Sonora, is being explored on and above the 800-ft. level. The mine has a depth of 1750 ft., but it is retarded by water below 900 ft. The 20-stamp mill is operating steadily, and 20 additional stamps are on the ground ready for installation. There is an ore reserve blocked equal to about four months milling.

Jumper—The underground force is being increased, and repairs on the mill are in progress. It is expected the full sixty stamps will soon be dropping.

Berkeley—This mine has been unwatered; ore is being extracted.

VENTURA COUNTY

The exhibition of free gold said to have been broken from the decomposed granite in Cuyuna valley, has started a rush of prospectors. A large number come from the Maricopa oilfield in Kern county, 35 miles distant.

Colorado

CLEAR CREEK AND GILPIN COUNTIES

Ohio—This mine in the West Argentine district started a new tunnel adit. This property has been a good shipper of lead ore. It is close to the Josephine that has lately shipped some of the highest grade lead in the district.

Capital—The mine has several sets of lessees that are making a good showing. Frank and John Hurley have encountered a streak of sheet galena that runs 2.28 oz. gold and 28 oz. silver with 60 per cent. lead. McCluskey, Long & Co. who have a lease on the east drift will ship 500 tons of concentrates to the company's mill. The company is working about 30 men and is shipping about $75,000 per month of smelting ore.

Burleigh—This company is opening ground on the Pelican vein and has exposed a body of high-grade smelting ore. A crosscut run from the Pelican tunnel to intersect the Unicorn vein is said to have uncovered 6 in. of ore that carries 500 oz. silver per ton. Mottschall & Co., lessees of a block on the Pelican, have a streak of smelting ore 7 to 12 in. wide that carries 50 oz. silver per ton.

Homestake—Work is under way on the construction of the dam on Bard creek for storage of water for the power plant.

McKinley—Development is under way in the McKinley property. The adit is in a distance of 500 ft. and the last 200 ft. in a body of mineralized quartz that is from 3 to 5 ft. wide.

National Mine—It is now stated that the National mine, on Quartz hill, Central City, lately purchased by the North American Mines and Smelter Company, has ore blocked out to a depth of 500 ft., sufficient to furnish 100 tons per day for many months. A modern hoist and compressor plant with machine drills has been installed. This company operates the smeltery at Golden. The ore is auriferous pyrite.

Topeka—The shaft is now down 1500 ft., and levels are to be run from the 1400 and 1500 points. The statement is made that the orebody, believed to average about $12 per ton, has been exposed in five levels and averages 4 ft. in width. H. P. Lowe is manager.

Pittsburg—High-grade ore is being taken out in sinking the shaft to the 1000 level. Drifts will be run from the 900- and 1000-ft. points.

LAKE COUNTY—LEADVILLE

Leadville—These claims east of the A Y. & Minnie properties, after an idleness of years will resume.

MINERAL COUNTY

The output for Creede for the first quarter is 7375 tons of smelting ore and concentrates, about 66 per cent. of this being concentrates.

Humphry—The mill is handling about 60 tons, mainly from the Collins lease on the Happy Thought mine.

SAN JUAN DISTRICT

San Pedro Gold Mines Company—In the main tunnel at 5700 ft. from the portal a vein of galena 2 ft. in width was cut on the Ouija claim of which samples taken across the vein give returns of 40 per cent. lead and $3 in gold and 12 oz. silver. The company owns about 50 claims in the Sneffel's district embracing an area of about 400 acres between the Revenue, Atlas and Camp Bird.

Jonathan—Martin Pouch and George Anderson, leasers, shipped a car of ore from this property at Ouray that assayed over 2 oz. gold.

Gold King—A force of men are preparing for the big force which will be put on soon.

Esmeralda—Leasers on the Esmeralda are shipping by "jack tram" from mine to railroad. The compressor is again in commission and two drills are working.

Queen Anne—Contractors on this mine, owned by Joe Bordeleaw, drove a 530-ft. crosscut during the winter and cut the vein, which proved to be 15 to 20 ft. wide, and containing milling ore.

SAN MIGUEL COUNTY

Mammoth—H. A. Dorfeld, who had a 250-ton mill-run from the Mammoth mine, will make a test at Bear Creek mill under the superintendency of M. A. Ballard. J. C. Brown and George H. Hall have taken a lease on the Weller group and will develop extensively.

TELLER COUNTY—CRIPPLE CREEK

Jo Dandy—A cyanide mill is being erected at this mine to treat 150,000 tons of dump which it is claimed will run $5 per ton. The Jo Dandy Company receives 12½ per cent. royalty on bullion obtained. Thomas Kavanaugh is the lessee.

Idaho

COEUR D'ALENE DISTRICT

Hunter—Among the improvements planned are the enlarging of the mine and the installation of an electric hoist and motor cars for hauling ore from the shaft to the bins on the tunnel level. The capacity of the mill also will be increased from 400 to 800 tons daily. The latter work is to be completed early in June. One hundred and fifty men are at work, the principal operations being on the 400-ft. level. Over $100,000 will be expended in improvements.

Federal—Development on the company's mine at Mace, has opened a large orebody on the 1800-ft. level. The company is negotiating for the purchase of the Cleveland claim.

Beartop—George J. Kiebler, manager, reports that the property will soon be operating.

Indiana

PIKE COUNTY

A big deal in coal lands near Muran is being made by a company headed by John Harmon, of Chicago. The company is paying $30 an acre; three large farms have been purchased, and 400 acres more are wanted. The above price is for the coal rights alone.

GRANT COUNTY

The new wells brought in on the Hardacre farm along the Baltimore & Ohio railroad are arousing some of the old-time interest in oil mining. The last well completed is said to be a 2000-bbl. gusher. Wells brought in on the Vandamark farm are likewise among the big producers in this county. These wells are producing 60 bbl. an hour.

GREENE COUNTY

The North American Oil Company, which controls oil lands southeast of Linton, is to make extensive developments in that field. The company has two wells completed and is pumping 43-deg. gravity green oil. Tanks with a storage capacity of 1000 bbl. are rapidly being filled. The officials are preparing to sink several other wells and also construct a pipeline to Bee Hunter, at the junction of the Southeastern and Vandalia roads.

VIGO COUNTY

The county commissioners have named Thomas McGregory, of Terre Haute; Mack Harris, of West Terre Haute, and William McCurdy, of Seeleyville, for the first board of examiners under the new law, which the governor declared in force this week. The law provides that all miners must pass an examination before being allowed to work in the mines. McGregory represents the operators, McCurdy and Harris the miners.

Kentucky

Elkhorn Consolidated Coal and Coke Company—A coal crusher and 50 beehive coke ovens are being erected at the mine at Hellier in Pike county. F. Rogers, Pikeville, is president.

Wilholt Consolidated Coal Company—A mine has been started on a tract of 1000 acres at Pineville, Harlan county. By October, 1911, it is expected 500 tons can be shipped daily. Roy Wilholt, Louisville, Ky., is president.

Michigan

COPPER

Hancock—This company has begun rock shipments to the Allouez-Centennial mills, about 250 tons of rock are being handled daily, coming from the No. 3 lode, tributary to No. 1 shaft and the shipments are to be increased as soon as the working conditions shape themselves.

Algomah—Drifting continues from the 104-ft. level, where the shaft has been bottomed for some time. About 1350 ft. of drifting has been done at this point, all of which has exposed good ground. The north drift is within 1000 ft. of the Lake boundary line.

South Lake—This company has discontinued its drilling and has selected a shaft site and it is very likely that active shaft work will be started at once. The overburden at the point selected is about 75 ft. Numerous drill cores have revealed a series of copper-bearing lodes, of which there is more or less difference of opinion existing as to their correlation with the Lake lode, but the gradual change in the strike of the Lake lode strengthens the assumption that the latter traverses and is one of the lodes exposed on the South Lake lands.

Franklin—This company has cut copper-rock as rich as anything previously exposed anywhere in its working, in the drift south between No. 1 and No. 3 shafts at the 23rd level. The copper appeared near the foot-wall side of the drift and a cut was put in across the formation showing it heavily mineralized. It is probable that this drift has been parallelling this copper-bearing portion of the lode for considerable distance. At the 26th level a cut was put in toward the footwall and a similar condition was met with.

Minnesota

CUYUNA RANGE

It is reported that Bullock Brothers, drillers of Aitkin, encountered a body of good ore while drilling for a well near the local hospital in the northern part of the town of Cuyuna. The land is owned by T. R. Foley, of Aitkin.

The Fayal and the Adams-Spruce mines, which have been two of the most consistent producers and shippers on the range, have both large quantities of ore ready for shipment. Both mines have been working steadily all winter, with large crews of men.

A large body of ore has been found in the SW., NE. of Sec. 10 T 46 R 29 by George H. Crosby, of Duluth. This tract adjoins the Interstate mine on the west.

Richleau & Whitesides—A find has been made by these parties in the SW., SW., Sec. 34 T 135 R 27 north and west of the Mississippi river and about half way between Crosby and Brainerd. This find indicates that the ore formation is considerably further north than was originally supposed and is therefore important. At 100 ft. depth the drill was still in mineralized ground.

Kennedy—This mine, operated by the Rogers-Brown Ore Company, is prepared to ship over the Soo Line to the new docks at Duluth. It is estimated that there are 200,000 tons of ore in stock awaiting shipment; 160 acres will be mined from this shaft.

Pine Tree—This is the name of the shaft to be sunk by the Rogers-Brown company in the S. ½, NW. of Sec. 11 T 46 R 29, during the coming summer. The orebody adjacent to this shaft is one of the largest ever found on the Cuyuna range, and is of an exceptionally fine grade.

Meachem—This shaft of the Rogers-Brown company in the NE., NE. of Sec. 11 T 46 R 29 is down 140 ft. and is being put in shape to produce this summer. Two "forties" will be mined from this shaft. There is no permanent hoisting machinery in place yet but the same will be on the ground in a short time.

Montana

BUTTE DISTRICT

North Butte—The Speculator shaft, which is still being sunk, is nearing the 2800-ft. level, to which depth it will be carried before a stop is made. At 2750 ft. the shaft passed through a new vein which is believed to be a north branch of the Edith May vein east of the fault. This vein, where cut, is 15 ft. wide, 5 ft. of it being bornite, averaging 22 per cent. copper, and the remainder a good grade of ore carrying copper glance and enargite. On the 1800-ft. level 16 ft. of ore having an average of 10 per cent. copper, has been encountered by a drift on the Crœsus vein. Below the rather barren zone between the 2000-ft. and 2300-ft. levels, rich ore has been encountered, which proves the theory of a secondary enrichment in this mine. Two fault veins have been discovered, which intersect at a point just above the 2200-ft. level, and a winze has been sunk from the 2200-ft. to the 2300-ft. level, proving the oreshoot to widen with depth. On the 2400-ft. level a drift is being run to tap this shoot, which should be encountered upon passing through the fault. Drifts will also be run on the 2600-ft. and 2800-ft. levels.

Butte Central—The shaft of the Ophir mine is being sunk rapidly, and is below the 700-ft. level. It is expected to reach the 1000-ft. level by the middle of July. Development is being done on the 100-ft. and 300-ft. levels, and considerable silver ore is blocked.

Davis Daly—In the interests of Eastern stockholders, W. H. Wiley, of Los Angeles, is making an examination of the Colorado mine of the Davis-Daly company, and upon his report will depend future operations. On the 1700-ft. level the vein recently struck, has been opened for 250 ft., at which point the orebody, which varies in width from 18 in. to 18 ft., has practically pinched out. Preparations are now being made to drift on the 1800-ft. level for the orebody.

DEER LODGE COUNTY

There has been talk of pending litigation between the Silver Lake Mining Company and the George Hill Mining Company, concerning the apex rights of the George mine of the former company, and the Roundup mine of the George Hill company, and it was thought that injunction proceedings were about to be instituted by both companies. At a meeting held April 5 in Anaconda, the differences were settled satisfactorily, and Mr. Stewart stated that the George Hill Company would begin operations as soon as the hoist could be hauled from Anaconda to the Roundup mine.

Hidden Lake—In nearly all of the 16 claims comprising the Hidden Lake group, development has exposed well defined veins carrying gold. At present most of the work is confined to the Gold Bug No. 2, on which claim a tunnel has been driven into the hill 250 ft. where it tapped the lead at a point 150 ft. below the surface. Raises have been driven on the lead to the surface, and a 50-ft. winze has been sunk, showing a continuous vein with an average width of 23 ft. in a country rock of brecciated quartzite. The bottom of the winze is still in oxidized quartz. The Doherty mill, which is about a mile from the property, has been leased, and a cyaniding plant added to it.

Oro Fino—Development at this property, Georgetown, has lately exposed some good orebodies. A winze has been sunk on the foot-wall from the 100-ft. level to the 200-ft. level, to which depth the shaft has also been sunk, showing high-grade gold ore in its entire length, and indicating a back of about 45,000 tons of ore. The mine is at present operated by a bucket and whim, but as soon as the ore blocked out warrants permanent instalment, the company will put in an engine and air compressor.

Ontario—George Hoadley, Dr. F. B. Moore, Wilfred St. Jean, Sam and Napoleon Landry, and others of Anaconda, have taken a lease on the Ontario mining claim in the Georgetown district for one year. This mine was a silver producer before the fall in the price of silver, at which time it was closed down, and it also carries small gold values.

GRANITE COUNTY

Bi-Metallic—The old Granite Bi-Metallic company in the Phillipsburg district has been absorbing claims in that vicinity for years, and now owns nearly 500 claims, a number of which are being worked by leasers who are shipping an average of 15 cars of silver ore per month.

Montana Frisco—Spokane capitalists have purchased this Phillipsburg property and are about to resume operations there. One of the largest gasolene hoists in Montana has been installed, and a concentrator will be built this summer. The shaft has been retimbered to the 350-ft. level, and retimbering will be continued to the 550-ft. level. As soon as the pump can be started the company will commence to ship ore, a large amount of which is now blocked out.

MADISON COUNTY

Frank Wyrouch—L. Lorenger, of Duluth, who has a lease on this property, in the Bear Gulch district, will begin the erection of a mill.

Nevada

LINCOLN COUNTY

The merger of the Pioche properties, announced recently, is held up by disagreement over details. It is expected that it will be consummated soon.

WHITE PINE COUNTY

Nevada-British—This company has perfected its title to the West Extension of Star, Chief of the Hill and Mascot patented claims near Cherry creek.

New Mexico

GRANT COUNTY

Granite Gap—This property is shipping lead-silver ore and developing. J. F. Dowling is in charge.

New Jersey

Pahaquarry Copper Company—This company is working its mine near the Delaware river, at Pahaquarry in Warren county, with a small force. The ore is crushed, hand-picked and handled by wagon to Dunfield.

Oklahoma

McGuire—These properties, at Davis, have recently been examined. A mill is planned.

Arbuckle—The work on the mill is under way.

Mason—Stearns, Anderson & Co. has purchased a lease of the Mason Mining Company, at Quapaw, and has started operating.

L. C. Church—This company, operating the deepest mine in the Miami camp, is still pumping and draining the entire camp. All the other operators have been relieved of the expense of pumping and have used the water for mill purposes, yet refused to bear any part of the expense of pumping. The Church company has now, by digging a deep ditch, turned its waste water away from the Miami camp. This will result in the shutting down of every producing mine in the camp, unless the operators consent to share in the expense of pumping, or put down deep wells for their own use.

Oregon

Baker County

Tom Paine—This mine is being equipped with a 10-stamp mill, which will soon be ready for operation. J. T. Parker, Sumpter, manager.

Cañon Mountain—This company has been organized to operate on Jack Chambers claims on Cañon mountain, one mile from Cañon City. Preparations are being made for considerable work.

Josephine County

American Belle—This property is to be equipped with a hydraulic plant and a complete sawmill outfit. Fred T. Osborne, Holland, secretary.

Wallowa County

Chief Joseph—This property is being operated by H. H. Mulkey, Joseph, who will do considerable development work during the season.

Red Cloud—Two tunnels are in over 40 ft., and one 250 ft., all touching the orebody. If sufficient ore is found, the property will be equipped with machinery. This mine is near Joseph.

Utah

Juab County

Victoria—Ninety-four sacks, or about five tons of ore have been shipped from the recent strike on the 1050 level. It is estimated that the ore will bring it in the neighborhood of $1500 a ton. Foundations for the new hoisting equipment are in place, and the engine and compressor will shortly be hauled up to the mine. As soon as the new equipment can be put in working order a much larger tonnage will be hoisted.

Eagle & Blue Bell—A new orebody has been opened in the northern part of the property, which it is thought may be a continuation of the Victoria vein. This ore is being developed by drifting and raising from the 1200. The main level has opened ore for 50 ft. while one raise has followed ore for 60 ft., and another raise for 80 ft. A winze below the 1200 is in ore 45 feet.

Grand Central—Experiments are being made on ore from this property, with a view to the possibility of installing a cyanide plant. The ore developed at depth is said to be running well in silver and gold, while its copper content is growing less toward the south. Drifting to the north is being done on the 1800, 1600 and 1300 levels, in the direction of the Victoria lines.

Lower Mammoth—A special stockholders' meeting will be called in the near future for the purpose of considering the proposed increase in capitalization from 250,000 shares par value $1 to 1,000,000 shares, of the same par value. This increase is generally favored by stockholders. Part of the resulting treasury stock will be sold for development instead of levying further assessments.

Mammoth—Ore has been opened for about 20 ft. on the 800 level northeast of the shaft. The find is of special interest, as it is in hitherto unexplored territory. The ore runs well in copper and silver with some gold.

Scranton—About 700 tons of ore a month are being shipped by this zinc-lead property in North Tintic.

Beck Tunnel—Underground conditions are steadily improving. Four cars of ore have been shipped since the compromise with the Uncle Sam company, and the officials feel that present operations will put the property on a paying basis. No assessment was called for at the April meeting.

Iron Blossom—Drifting is being done on the 600-ft. level of the No. 3 shaft for the orebody opened in the cave some months ago. Ore from the north drift on the 600 level of the No. 1 shaft assays up to 60 oz. in silver, and from $2 to $20 in gold. Recent development on the 400, 500 and 600 levels has shown the orebody to be practically continuous.

King William—The drift on the 1900-ft. level has cut a north-south fissure carrying quartz with slight copper staining. This is considered encouraging.

Sioux Consolidated—A 25-ton shipment of copper ore was made during the week, which is reported to have carried around 8 to 10 oz. silver, 15 per cent. copper, and some gold per ton. This character of ore has not been produced by the property heretofore.

United Tintic—The shaft is down 225 ft. A station was cut at the 210-ft. level, and a crosscut driven to the Bullock vein, on which about 300 ft. of drifting has been done. The north face shows alternating streaks of quartz and ore, the latter carrying around 7 per cent. copper and 18 oz. silver. A car of 30 tons will be shipped shortly.

Salt Lake County

Bingham Mines—Raising has been in progress between the old workings and the Niagara tunnel. Connections are nearly completed. Some ore has been encountered in this work, and shipments will be resumed in the near future. A contract has been given to H. H. Green for the final cleanup around the former Bingham Consolidated copper smeltery at Midvale. Mr. Green was formerly general manager, and made a cleanup of flue dust, etc., several years ago, when the plant was shut down. Work has been started. The equipment, including the buildings, machinery and tools, will be sold.

Montana-Bingham—Samples of ore from the Eddy tunnel running well in copper, and carrying around $10 in gold, with a little silver are being shown in Salt Lake from a high-grade streak recently encountered.

Bingham Amalgamated—A new strike of shipping ore has been made by Henry Wolf, who is leasing on this property. The ore is a heavy sulphide, and carries from 3 to 4 per cent. copper, with some silver and gold. It is said to be opened for 18 ft. One car has been shipped, and five more are ready.

Columbus Consolidated—It is proposed to make a mill test with a good-sized tonnage of low-grade ore, with the idea of making some additions or alterations to the mill to treat this class of material.

Washington

Chelan County

Wenatchee—Machinery will be installed and development pushed. J. E. Jorgenson, Entiat, is superintendent.

Ferry County

McKinley—About $50,000 will be spent for machinery and development work on this property, near Orient. A large amount of ore is now exposed.

Hidden Treasure—Some high-grade ore was struck on First Thought mountain recently. The property is owned by Norman Gourley, of Orient.

Knob Hill—Power drills have been installed, which will greatly increase the output of this mine. Joseph McFarland, Republic, superintendent.

North Washington Power and Reduction—A large amount of machinery is on the ground for installation at this plant, at Republic. Ore is being placed on the dumps at the various mines to await the completion of this plant.

Little Michigan—This mine has been shut down. The property is owned by

Michigan and Rosalia capital. Much development has been done.

WALLA WALLA COUNTY

Old Dead Medicine—At this mine, which is owned by the Clugston Mining Company, near Evans, high-grade ore has been uncovered. The strike is 4 ft. wide, and was made at a depth of 215 feet.

Wisconsin

The Campbell Magnetic Ore Separating Company, which has been operating a small plant for the last year at Cuba City, will enlarge. J. B. Etherington is manager.

Joseph Longbotham and others have formed a company to conduct a custom-roasting business at Benton; two roasters have been purchased which will be moved and reassembled.

Little Minnie—The 100-ton mill, burned three months ago, has been replaced and operations resumed.

Cleveland—Construction of a 100-ton mill, at Hazel Green, has been completed.

Sunset—A 6-inch sheet of jack was struck beneath the old workings of this property, which was abandoned by the Union Zinc Company.

Dall—The mine at Cuba City has closed as the ore run has been lost.

Baxter—This Cuba City mine has been doing some successful prospecting and has decided to move the mill to a location where it will be safe from caving.

Calvert—The mine at Benton is being cleaned up preparatory to shafting down.

Frontier—This mine, at Benton, is shipping three cars a week and has recently found promising ground in drilling on the Hird lease.

Ollie Bell—The mine has been closed and the crew shifted to the Fox mine, where a new air shaft will be sunk; it is producing 25 to 40 tons of concentrates daily.

Bronson—This concentrating company expects to have its testing mill completed by May 1; it will use an air process.

Crooked Six—The mine operating on the McCabe lease near Benton has contracted for a small mill.

Goosehorn—The mine at Dubuque is installing a pump to prospect further its rich run of high-grade jack.

Canada

ONTARIO—PORCUPINE

The electric-light plant is completed for lighting Golden City. The Northern Ontario Land Company is getting ready to lay pipes from Bob's lake to supply Golden City with water.

The Temiskaming & Northern Ontario railway is clearing the grounds for the station at Golden City. Most of the grading is complete to within two miles of this point, and the engineer says that trains will be running into Porcupine July 1. The Northern Ontario Trust, Ltd., is building a sawmill at Golden City.

Dome—The Merrill Metallurgical Company, of San Francisco, has the contract for the construction of the Dome mill. Henry Anson is construction engineer. A. D. Niles is metallurgist for the Dome mines. One hundred and seventy-five men are at work and the property is well equipped.

Dome Extension—H. C. Anchor, manager of the property, succeeded in getting the machinery before the breakup and is preparing to build the power house. The company is sinking by hand.

Preston East Dome—Machinery and supplies have been brought in to the property in Deloro township and the engine house is nearly completed.

Standard—H. M. Roche has completed the design of the 40-ft. headframe for this property and the foundation is being prepared. The hoist and boiler are in place and sinking will continue as soon as headframe is completed. The shaft is down 40 feet.

West Dome—Since beginning operations Feb. 19, 1250 ft. of drilling has been done and the vein has been cut at 110, 216 and 326 ft. The quartz vein passes through a dark schist in which are various sulphides for many feet.

Pearl Lake Gold Mines—Two shafts are down 35 ft. each and a third is being started. The work on the property is being done by contract.

Rea—The 8-drill compressor which was ordered six weeks ago is now running. Four shafts are being sunk and are down 175, 66, 27 and 16 ft. respectively.

Lindburg—A diamond drill is being set up to prospect this property. The property adjoins the Rea mines on the southeast.

Smith Vet.—Three hundred feet of stripping has been done and free-gold specimens are found at several points.

Imperial—The shaft is down 50 ft. and crosscutting has begun.

North Thompson—The vein is 4 ft. wide and shows free gold. It is believed to be a continuation of Vipond vein.

Crown Charter—The third diamond-drill hole is now down 125 ft. on the Camp claim. On the South claim the shaft is down 40 ft. and will be hurried to the 100-ft. point where a station will be cut and crosscutting begun.

Clusky Vipond—Two test pits have been put down 12 and 18 ft. respectively, in which quartz leads are uncovered. Stripping has been going on for two months.

Mexico

CHIHUAHUA

The Parral camp produced for the week ended April 15 as follows: Shipped to smelteries, 5000 tons; treated locally, 8300 tons; total, 13,300 tons. The March production was, shipped 40,000 tons; locally treated 20,500 tons; total, 60,500 tons.

Soledad—This property in the Almaloya district has been acquired by a French syndicate represented by E. Bronimann, of Santa Rosalia. A company of the same name, capital 200,000 pesos, has been organized.

Rio Plata—The company announces net operating returns for March $24,386 from a total silver recovery of 70,009 ounces.

Dolores—This property of the Mines Company of America recently shipped 230,000 pesos of bullion through the Chihuahua bank. A previous shipment went by way of Toniche, Sonora.

GUANAJUATO

La Profeta—This company, in the Rayas district, has made a shipment of rich ore. Cecil O'Gorman, of Mexico City is in charge.

MEXICO

Esperanza—The March report shows ore crushed, 23,539 tons, yielding $163,524, of which amount $68,947 was net.

SONORA

The Mexican Union railway, running from Torres to Minas Prietas, is being extended to Ures, a distance of approximately 60 km. There is at present 10 km. of rails down and 15 km. of grade finished. Like the mines the railroad is suffering from a shortage of labor and it will probably be January before it is finished.

La Dura—A tramway 1000 ft. long has been installed across the Yaqui river for this property, owned by the Mines Company of America.

Creston-Colorada—This property, at Minas Prietas, owned by the Mines Company of America, has treated, Jan. 1 to April 1, 42,260 tons of ore and 6600 tons of slimes in the Colorada and Butters mills. Of the ore 34,633 tons was from the Colorada, mostly from the upper levels.

Penn-Sonora Mining Company—This company has incorporated in Arizona to operate El Durazno claims in the district of Magdelena. The president of the company is W. R. Lyon, of Glenfield, Penn.

South America

COLOMBIA

Concordia—This group of mines in the Pasto region in southern Colombia has been sold to a New York and London company known as the Gualacala Mines Company, of which R. A. Linton is vice-president. The mines have a record of large output of gold.

The Markets

Coal Trade Review

New York, April 26—Coal trade in the East remains rather quiet, and the developments so far do not point to an active summer in the seaboard bituminous market. Spring trade is slow to open, and contract making is backward.

The anthracite trade, on the other hand, is active. Dealers are taking advantage of the April discounts in an unusually large way. Coal has begun to move to Buffalo for Lake shipment, but only in a small way so far.

In the West the coal trade is still unsettled and operators are not too happy over conditions. Operations at mines continue slow, and trade in steam coal does not improve much. Shipments have been curtailed in some degree, so that there is less congestion and less pressure to sell coal at the large consuming centers. Lake trade opens very slowly and there is a large quantity of coal intended for shipment up the Lakes, which is held up until the boats get busy.

An interesting item of news is the final disposition of the coal interests which John R. Walsh gathered up. After his failure these were collected into an organization known as the Alliance Coal Company. That concern has now sold out to the Vandalia Coal Company, making it the largest operating company in Indiana. It is thought that the Southern Indiana—Walsh's coal railroad—will pass under Pennsylvania control. This ends a chapter of "high finance," which involved a disastrous bankruptcy and a prison term for the chief operator.

New Coal Line—Chesapeake & Ohio officers have organized a company to build a branch from that company's Big Sandy division at Ward, in Pike county, Ky., following the Levisa fork, crossing into Buchanan county, Va., and thence to Grundy, the county seat. The line will cross the mountains seven or eight miles north of Russell fork at the Breaks of Big Sandy. There is no railroad at present in Buchanan county, and the new line will open up an entirely new territory for traffic. It will be 40 miles long, and will run through some good coal territory.

Coal Traffic Notes

Coal tonnage of Norfolk & Western railway nine months of fiscal year from July 1 to March 31, short tons:

Field	Commercial	Company	Total
Pocahontas	7,814,868	820,190	8,635,058
Tug River	1,256,867	362,075	1,618,942
Thacker	1,135,286	472,340	1,607.626
Kenova	545,185	121,567	666,752
Clinch Valley	692,021	37,981	730,002
Total	11,444,227	1,814,153	13,258,380

Current Prices of Metal, Minerals, Coal and Stocks, Conditions and Commercial Statistics

The total increase over the corresponding period in 1909-10 was 1,398,008 tons, or 11.8 per cent.

Coal tonnage originating on lines of Southern railway in January: Tennessee district, 114,805; Alabama district, 244,112; total, 358,917 short tons, a decrease of 7508 tons from last year.

Coal shipments through locks on the Monongahela above Pittsburg, two months ended Feb. 28, were 1,646,000 short tons in 1910, and 1,895,820 in 1911; increase, 249,820 tons.

Coal passing Davis Island dam on the Ohio, two months ended Feb. 28, was 590,030 short tons in 1910, and 1,022,330 in 1911; increase, 432,300 tons.

Coal shipments out of Kanawha river in West Virginia, two months ended Feb. 28, were 192,600 short tons in 1910 and 240,040 in 1911; increase, 47,440 tons.

Coal receipts at St. Louis, two months ended Feb. 28, were 1,810,580 short tons in 1910, and 1,345,394 in 1911; decrease, 465,186 tons.

Coastwise shipments of coal from chief Atlantic ports, two months ended Feb. 28, long tons:

	Anthracite	Bitum.	Total	PerCt.
New York	2,562,206	1,927,319	4,489,525	61.2
Philadelphia	366,697	715,720	1,082,417	14.8
Baltimore	40,595	763,625	804,220	11.0
Newp't News	.....	431,320	431,320	5.8
Norfolk	.....	525,715	525,715	7.2
Total	2,969,498	4,363,699	7,333,197	100.0
Total, 1910.	3,043 606	3,974,435	7,018,041	.....

Total increase this year, 315,156 tons, or 4.5 per cent. New York includes all the harbor shipping points; Norfolk includes Sewall's Point.

Coal shipments over railroads in the Ohio Coal Traffic Association, two months ended Feb. 28, short tons:

	1910	1911	Changes
Hocking Valley	771,414	519,310	D. 252,104
Toledo & Ohio Cent.	276,090	205,667	D. 70,423
Baltimore & Ohio	373,438	305,590	D. 67,848
Wheeling & L. Erie.	587,374	461,049	D. 126,325
Cleve., Lorain & Wh.	487,543	337,356	D. 150,187
Zanesville & Western	250,247	198,330	D. 51,917
Toledo Div., Pen. Co.	435,677	344,083	D. 91,594
L. Erie, Alliance & W.	203,960	220,314	I. 16,354
Marietta, Col. & Clev.	25,825	4,901	D. 20,924
Wabash-Pitts. Term.	8,839	13,091	I. 4,252
Kanawha & Mich.	.....	10,066	I. 10,066
Total	3,420,407	2,619,757	D. 800,650

Total decrease this year was 23.4 per cent. Baltimore & Ohio tonnage is of the Ohio lines only; main-line tonnage is given elsewhere.

New York

Anthracite

April 26—Dealers have been taking advantage of the April discounts on domestic sizes and sales have been large to tidewater. All-rail business is also reported good. Steam sizes are in better supply.

Schedule rates on domestic sizes for April are $4.25 for lump, $4.50 for egg and stove and $4.75 for chestnut, all f.o.b. New York harbor. Next week there will be an advance of 10c. all around. On steam sizes quotations are: Pea, $3@3.25; buckwheat, $2.35@2.80; No. 2 buckwheat or rice, $1.80@2.30; barley, $1.40@1.75; all according to quality, f.o.b. New York harbor.

Bituminous

Coastwise trade is still slow, but harbor trade is picking up a little. Contract making still drags. Mines are limiting shipments and there is not much pressure to get rid of coal, since most shipments to tide are on orders.

Off-shore business is reported from Baltimore and Norfolk as unusually good; it is taking quite a quantity of Fairmont and Pocahontas coals.

There is nothing new about prices, except that gas slack is scarce and 5c. premium is reported on some lots. For steam coals the lowest prices named are $2.40@2.50, New York harbor, for lower grades, with higher-grade coals up to $2.85@2.95. A fair Miller vein coal brings about $2.60@2.65. Gas coals can be had at $1.05@1.10 for ¾-in., $1@1.05 for run-of-mine and 75@80c. for slack, all at mines.

Weather has favored the coastwise trade and vessels are in good supply. Rates are about the same, but the tendency is to a little lower basis.

Birmingham

April 24—The coal trade in Alabama continues dull. Production is held down considerably. No concessions to amount to anything will be made to secure business in coal.

The feature of the past week in the coal and coke industry in Alabama was the starting up of the 60 byproduct coke ovens of the Woodward Iron Company. The ovens are of the Kopper patent and will have a capacity of 750 tons of coke per day, 7000 gallons of tar and about 10 tons of sulphate of ammonia. As fertilizer works throughout the South use the last-named commodity in great quantity a good business is expected in that product. The Tennessee company is building 300 of the same patent coke ovens at Corey-Ensley, near Birmingham.

Chicago

April 25—The coal market, in general, is in good condition, with the demand large for all kinds of steam and domestic coals and prices maintained in default of any great surplus on tracks. Many dealers, indeed, say it is the best April they have known in years. There is danger, however, of a slump if too large shipments arrive. From the Illinois and Indiana supply districts the shipments have been in the last week just about right. Eastern coals are less satisfactory; smokeless is the subject of considerable price cutting and yet holds up fairly well to standard quotations. Contract making is heavy and prices on the average are low.

Illinois and Indiana bring for most of the coal sold $1.80@2.30 for lump, $1.70@1.85 for run-of-mine and $1.60@1.85 for screenings. Smokeless brings $2.95@3.05 for run-of-mine and $3.15@3.40 for lump. Hocking is quiet and firm at $3.15. Anthracite sells well at the April discount prices, with buying unusually good and well distributed. For steam purposes the fine coals have the preference, to such an extent that they are salable at the higher rather than the lower quotations.

Cleveland

April 24—A few vessels have sailed with coal, but only a few. Railroad yards are full of coal for shipment, but boats are not ready. The railroads are generally refusing to take Lake coal from the mines, until there is some prospect that it can be moved.

Local trade is dull. Slack is scarce for the time being, but it will be plentiful when Lake coal begins to come in freely. Prices are unchanged.

Indianapolis

April 24—Conditions throughout the mining districts of Indiana are a little more encouraging. At present there is but one insignificant strike on involving about 30 men. A number of mines have resumed operation, giving fair hint of improvement in the coal business.

While coal shipments in this State are not up to the volume usual for this time of year, the situation depends on the condition of the manufacturing industries. Any improvement in manufacturing is felt at once by the mines.

Pittsburg

April 25—Hearings started in Washington yesterday before the Interstate Commerce Commission on the Pittsburg-Lake coal rate and will probably consume all week. Railroad officials proved rather uncommunicative witnesses and the subject seemed to be full of matter they desired to conceal. It is expected the Pittsburg and West Virginia cases will be consolidated, the Commission having recently postponed the advance in the West Virginia rate to Sept. 15. Coal movement continues rather light both in the local consuming market and in the Lake trade. Prices are unchanged and remain quotable as follows: Nut, $1.05@1.15; mine-run, $1.10@1.15; ¾-in., $1.25; 1¼-in., $1.35; slack, 75c. per ton at mine.

Connellsville Coke—While production has been somewhat decreased there is coke going into stock and another week will probably see an effort to sell it at cut prices. In the past week there has been nothing done, and while the situation indicates that old prices are purely nominal, no new basis for quotations has been afforded. Shipments were recently started to two merchant furnaces, Mary at Lowellville, O., which blew in a few days ago, and Tod, at Youngstown, O., which is to go in this week. The Steel Corporation has blown out four or five furnaces in the past week and will probably blow out some more before the end of the week. We quote former prices nominal as follows: Prompt furnace, $1.60@1.65; balance first half, $1.65@1.70; second half, $1.75@2; prompt foundry, $2@2.10; contract, $2.20@2.40, at ovens.

The *Courier* reports production in the Connellsville and lower Connellsville region in the week ended April 15 at 349,475 tons, a decrease of 13,000 tons, and shipments at 3852 cars to Pittsburg, 5834 cars to points west and 623 cars to points east, a total of 10,309 cars.

St. Louis

April 24—Despite the little cool weather we have had this week the demand for coal has been slack and all sizes are indeed sluggish on the market. Lump coal has moved very slowly and screenings have dropped down to 62½c. Of course, this has had its effect on the other sizes which have also fallen off in price.

The demand for high-grade coal is dull locally and most of the lump and nut sizes are moving to the Southwest. On country orders as low as $1 is being asked for lump. There is practically no demand for any Carterville coal on the St. Louis market and very little domestic coal is being moved excepting a few cars of lump and nut to the retail yards.

Anthracite—The movement of anthracite is very slow for this time of the year and, although quite a little chestnut is coming forward, it is hard to move. There has not been as much speculation in hard coal among the jobbers of St. Louis as there was last year, owing to the number of firms handling it this year.

FOREIGN·COAL·TRADE

British Coal Trade—Exports of fuel from Great Britain, with coal sent abroad for use of steamships in foreign trade, three months ended March 31, long tons:

	1910.	1911.	Changes.
Coal	13,357,353	15,201,352	I. 1,843,999
Coke	235,379	251,671	I. 16,292
Briquets	343,968	425,246	I. 81,278
Total exports	13,936,700	15,878,269	I. 1,941,569
Steamer coal	4,405,962	4,701,509	I. 295,547
Total	18,342,662	20,579,778	I. 2,237,116

Imports of coal were only 3378 tons in 1910, and 3341 tons this year.

Welsh Coal Prices—Messrs, Hull, Blyth & Co., London and Cardiff, report prices of coal on April 15, as follows: Best Welsh steam coal, $4.14; seconds, $3.90; thirds, $3.78; dry coals, $3.84; best Monmouthshire, $3.72; seconds, $3.54; best small steam coal, $2.46; seconds, $2.22. All prices are per long ton, f.o.b. shipping port, cash in 30 days, less 2½ per cent. discount.

IRON·TRADE·REVIEW

New York, April 26—The markets, as a rule are quiet, both buyers and sellers holding to a waiting position, except in a few lines.

The incident of the week is the sale of large lots of Lake Superior iron ore at a reduction of 50c. from last year's prices. This fixes the prices for the season—not by any concerted agreement, it is carefully explained. The new prices for bessemer ores are $4.50 for Old Range and $4.25 for Mesabi; for nonbessemer ores, $3.70 for Old Range and $3.50 for Mesabi.

The question of ore prices for the season was a very awkward one. The 50c. advance for 1910 was settled upon late in December, 1909, after the pig-iron and steel market had had an advance for five or six months, but the event proved that it was after the market had entered upon a twelve months' decline, which soon left ore prices quite out of line, but the unsatisfactory iron and steel market left stocks of ore and pig iron in the hands of merchant furnaces, upon which a depreciation would be written by a reduction in ore prices for this season. Accordingly the majority of ore buyers preferred to see 1910 prices on ore maintained, if that could be done safely. The steel interests urged that no reduction be made, while a number at least of the ore interests wished a reduction. Such an alinement of interests has been quite unusual in the trade.

The effect of the ore reduction upon the pig iron has been to accentuate the stagnation, if such a thing is possible. Some inquiry was developed, but it represented merely curiosity. Pig-iron prices have not come down and consumers will not buy until they do, or until they are convinced they will not. There is much ore and pig iron in existence, to be taken care of before pig iron made from the new ore gets into the market, and it remains to be seen whether these stocks will force a lower market.

Upon finished-steel prices the ore reduction is held not to have any bearing. The present finished-steel price structure represents the arresting of the decline which occurred in the first six or seven months of 1910 by the establishment of a controlled market and the idea is to hold everything where it is. In the face of a restricted demand this has been very difficult, but will hardly be much more difficult by reason of the ore reduction.

The demand for structural steel continues strong. Small orders come in steadily and a number of important contracts are forward, some actually under negotiation and others soon to come. Fabricators continue to take contracts at prices significant of reductions in steel. Outside of structural steel the market has been quiet with new business light.

One of Judge Gary's dinners to the steel trade is to be given next week, on May 4. It is stated that "no business question will be considered;" but there will doubtless be some discussion of the situation. A meeting is being held in New York today.

It is reported that contracts have been closed for 200,000 tons of iron ore from Wabana, Newfoundland, for furnaces in the East. Shipment will begin this month from the mines to Philadelphia.

United States Steel Corporation—The statement of the Steel Corporation for the quarter ended March 31 is as follows:

Net Earnings:	1910	1911
January	$ 11,316,013	$ 5,869,416
February	11,616,861	7,180,928
March	14,684,002	10,468,859
Quarter	$37,616,876	$23,519,203
Depreciation funds, etc		$3,517,386
Interest and sinking funds		7,311,962
Total charges		$10,829,348
Surplus		$12,689,855
Dividends paid		12,658,700
Balance undivided		$ 31,155

Dividends were $6,304,919, or 1¾ per cent., on preferred, and $6,353,281, or 1¼ per cent. on common stock. No appropriations for new construction were made. There was a decrease of $2,382,526 in net earnings from the fourth quarter of 1910.

Baltimore

April 24—Exports for the week included 1,780,574 lb. structural steel, 548,405 lb. plates and 794,052 lb. miscellaneous iron and steel to Panama. Imports included 200 tons ferromanganese from Liverpool; 40 casks manganese ore from Hamburg; 19,950 tons iron ore from Cuba.

Birmingham

April 24—A few scattering sales of pig iron in Southern territory saved the day. The market is dull. The shipments of iron being made are in the main on orders which were booked some time back. There is not much accumulation but the make is being held down and will be further cut shortly unless there is improvement in conditions. The quotation is still $11 per ton, No. 2 foundry, and, while one or two companies are holding out of the market at that price for delivery during the last quarter of the year, the quotation is general for the balance of the year.

The accumulated stocks of pig iron do not show much reduction lately.

Chicago

April 25—It is a dull, flat and unprofitable iron market and one that seems destined to continue such indefinitely. The average foundry melter, upon whom this market depends, seems to be of the fixed opinion that he will do best to buy in small lots, often, and his general requirements have fallen off considerably in the last month. Production seems, also, to be running at least a little beyond consumptive possibilities. Most of the founders have their needs covered to the end of the first half and are buying for third quarter, lightly. A few are in the market for the entire last half and they are getting low quotations on Southern; Northern remains more nearly firm, in view of the lessened production. Only greatly lessened production seems likely to produce a change before the end of the summer. The average purchase is from a carload to 300 tons; occasionally a sale running up to 1000 tons is reported.

Southern is quoted at $11 Birmingham, or $15.35 Chicago, for No. 2, and Northern at $15, with either probably obtainable for a little less, on any large contract.

The market for iron and steel products continues quiet, with structural steel and railroad supplies, the leaders, selling fairly well, though nowhere is there marked vigor in the market. Coke is dull at $4.75 for Connellsville.

Cleveland

April 24—The first shipment of ore was from Escañaba, April 17, by Corrigan, McKinney & Co., and other boats are being loaded. Shipments will be slow for some time.

Pig Iron—Only small sales and inquiries are noted. Prices are unchanged.

Finished Material—Some bridge and building contracts have been closed. There has been some lively cutting in sheets, with a fair demand. Some shading in billets is also reported.

Philadelphia

April 25—The point of interest at present is whether the reduction on merchant ore will affect the price of pig iron. The present outlook is discouraging and some prominent makers predict that the trade in pig will be in small lots for immediate delivery. There is very little business in basic pig. In forge iron demand is provokingly slow. Foundry irons are dull at a time when they are unusually active. Fresh offerings of Southern irons have been made within a few days without any sales of moment though an option or two has been taken to terminate at the end of this month. Pig-iron interests in this territory are marking time, awaiting developments and at best it is impossible to say anything of an encouraging nature. Some brokers report small sales of No. 2 X foundry at $15.75, gray forge at $14.50 for Northern and best Southern basic is $15 nominally.

Steel Billets—Billets are more active in a hand-to-mouth way, several lots of forging having been arranged for. It is understood the purchases are made on better terms to the buyers.

Bars—The bar mills are cutting their activities down to the maintaining of comfortable assortments. The distribution of refined iron is naturally improving at this season though at best the volume of business is far from sufficient to keep capacity fully engaged.

Sheets—Sheet manufacturers report more favorably. The week's business has been made up of contracts from a number of large users of sheets and it is intimated today that the business was secured at some shading below ruling quotations.

Pipes and Tubes—The week's business includes three or four contracts for cast pipe which have been hanging fire for several weeks. Merchant pipe is under better inquiry and the tone of the entire market is good.

Plates—Business in plates has run considerably above the average up to today. Most of the orders are for comparatively small lots.

Structural Material—The volume of business shows a decided improvement as measured by the numbers of orders under 1000 tons. Spring and summer construction requirements are figuring up handsomely. Important bridgework contracts were closed late last week. Car-building work is making a strong impression.

Scrap—Some of the larger dealers have worked off some of their surplus heavy steel scrap and there has been a more liberal movement in the cheaper and less-used grades. Prices have slightly weakened under the vigorous efforts of scrap dealers to unload.

Pittsburg

April 25—The event of the week from a news standpoint was the settlement of the question of Lake Superior iron-ore prices for the season. Instead of meeting and making a formal agreement, as used to be done years ago, the ore interests canvassed the subject in an informal way, holding a meeting in Cleveland on Apr. 11 and in New York, with some of the steel interests on Apr. 18,

and then on the morning of Apr. 21 the Shenango Furnace Company, known as the Snyder interest, announced that it had sold two lots of Mesabi bessemer ore aggregating 200,000 tons at $4.25 and four lots of Mesabi nonbessemer ores aggregating 550,000 tons at $3.50, both on Lake Erie dock, same analysis guarantees as in previous years. This opened the market at prices 50c. under those of last season, restoring the prices of 1908 and 1909. The market may now be said to be in full swing, but tonnages are being closed rather slowly. There was a total of 2,000,000 tons or more reserved more than a month ago, and this will doubtless all be converted into flat sales at the new prices.

A series of meetings in the different branches of the finished-steel trade is being held, preparatory to the general meeting on the occasion of the Gary dinner in New York on May 4, and the first of these occurred this afternoon, in the tinplate branch. Nothing of importance was developed, as the tinplate trade has been running smoothly, with prices firmly maintained. Although it is the hight of the tinplate season the mills are not running altogether full, at between 80 and 85 per cent. of capacity. This has been so much increased that the prospect is nevertheless for record tinplate production this year.

Finished-steel business on the whole is lighter than it was a week or fortnight ago, which means that an extreme state of stagnation has been reached. The railroads, whether by definite agreement or merely by the interchange of information, have adopted the uniform practice of limiting their purchases to the requirements of 30 days, instead of three or four months as formerly.

Independent steel interests in several instances started curtailing production several weeks ago, but as to finished material only rather than as to pig iron also. The Steel Corporation last week started to curtail and has blown out four or five blast furnaces to date, with two or three more to go out this week. Finished-steel products are being produced at between 60 and 65 per cent. of capacity, against between 70 and 75 per cent. at the high point early in March.

Pig Iron—The market is entirely stagnant. Prices are nominally unchanged, and we continue to quote: Bessemer, $15; basic, $13.75; No. 2 foundry, $14; malleable, $13.75, all at Valley furnaces, 90c. higher delivered Pittsburg.

Ferromanganese—The market is quiet and is quotable about 25c. lower, at $36.50, Baltimore, freight to Pittsburg being $1.95 per ton.

Steel—Reports of cut prices being available in open-hearth billets and sheet bars are current, but are not traceable to definite tonnages, and it appears that prices are being strictly held, although the market is stagnant and deliveries on contracts are smaller this month than last, with prospects of further decrease for next month. We quote billets at $23 and sheet bars at $24, f.o.b. maker's mill, Pittsburg or Youngstown, and rods at $29, Pittsburg.

Sheets—Demand continues rather light. Prices are fairly well maintained, but there is shading in some districts. We continue to quote: Black sheets, 2.20c.; galvanized, 3.20c.; blue annealed, 1.65c.; painted corrugated, $1.55; galvanized corrugated $2.75 per square.

FOREIGN IRON TRADE

Italian Imports—Imports of iron and steel into Italy in 1910 were: Pig iron and castings, 230,711; steel ingots, billets and scrap, 415,247; finished iron and steel, 181,070; total, 827,028 metric tons, a decrease from 1909 of 102,603 tons.

German Foreign Trade—Exports and imports of iron and steel and of machinery in Germany, two months ended Feb. 28, metric tons:

	Exports.	Imports.	Excess.
Iron and steel..	800,546	87,486	Exp. 713,060
Machinery.....	56,165	7,758	Exp. 48,407
Total.....	856,711	95,244	Exp. 761,467
Total, 1910.....	737,921	89,070	Exp. 648,851

Imports of iron ore in 1911 were 1,004,450 tons; exports, 427,833 tons. Imports of manganese ore, 43,943 tons; exports, 597 tons.

METAL MARKETS

New York, April 26—The metal markets generally show little change and no special incident. Sales of copper have been larger.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold:			
Mar. 1911..	$ 505,615	$ 4,119,063	Imp.$ 3,613,448
" 1910..	1,815,815	4,373,885	Imp. 2,558,070
Year 1911..	1,854,024	19,465,737	Imp. 17,611,713
" 1910..	10,916,081	9,568,358	Exp. 1,347,723
Silver:			
Mar. 1911..	5,896,795	3,197,409	Exp. 2,699,386
" 1910..	4,552,624	3,994,456	" 558,168
Year 1911..	16,001,042	10,746,781	" 5,254,261
" 1910..	13,639,547	11,398,139	" 2,241,408

Exports from the port of New York, week ended April 22: Gold, $831; silver, $869,406, chiefly to London and Paris. Imports: Gold, $146,812; silver, $177,207, from Mexico and Central America, principally.

Gold—With no special demand, prices on the open market in London remained at the normal level, 77s. 9d. per oz. for bars and 76s. 4½d. per oz. for American coin. Supplies were divided between India and the Bank of England.

Platinum—The market is steady and unchanged. Dealers ask $41@42 per oz. for refined platinum; $43.50@44.50 per oz. for hard metal.

Our Russian correspondent writes under date of April 13 that demand continues good and the market is strong. Prices, however, are subjected to some fluctuations. The latest quotations for crude metal, 83 per cent. platinum, are 9.30 rubles per zolotnik, at Ekaterinburg, and 35,000 rubles per pood at St. Petersburg—equal to $34.97 and $34.30 per oz., respectively.

Silver—The market has been an advancing one the past week, owing to combined orders from Indian bazaars and China. This inquiry has in a measure been satisfied and the demand is not so strong at the close of business today.

SILVER AND STERLING EXCHANGE

Apr.	20	21	22	24	25	26
New York....	53¾	53⅝	53⅞	54⅛	54⅛	53⅞
London	24¾	24¾	24 1/16	24 1/16	24 1/16	24 3/16
Sterling Ex..	4.8630	4.8640	4.8645	4.8655	4.8650	4.8660

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to April 13, as reported by Messrs. Pixley & Abell:

	1910	1911	Changes
India.....	£1,896,800	£2,831,400	I. £ 934,600
China.....	1,088,500	752,800	D. 335,700
Total.....	£2,985,300	£3,584,200	I. £598,900

India Council bills in London brought an average of 16.08d. per rupee for the week.

Copper, Tin, Lead and Zinc

NEW YORK

Apr.	Copper: Lake, Cts. per lb.	Copper: Electrolytic, Cts. per lb.	Tin: Cts. per lb.	Lead: New York, Cts. per lb.	Lead: St. Louis, Cts. per lb.	Zinc: New York, Cts. per lb.	Zinc: St. Louis, Cts. per lb.
20	12⅛ @12⅜	11.95 @12.05	42⅜	4.40 4.42½	4.25 @4.27½	5.37½ @5.42½	5.22½ @5.27½
21	12⅛ @12⅜	11.95 @12.05	42¼	4.40 4.42½	4.25 @4.27½	5.37½ @5.42½	5.22½ @5.27½
22	12⅛ @12⅜	12.00 @12.05	42½	4.40 4.42½	4.25 @4.27½	5.37½ @5.42½	5.22½ @5.27½
24	12⅛ @12⅜	12.05 @12.10	42⅞	4.40	4.22½ @4.27½	5.37½ @5.42½	5.22½ @5.27½
25	12⅛ @12⅜	12.05 @12.10	42¾	4.40	4.22½ @4.27½	5.37½ @5.42½	5.22½ @5.27½
26	12⅛ @12⅜	12.00 @12.10	42⅝	4.40	4.22½ @4.27½	5.37½ @5.42½	5.22½ @5.27½

The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis New York, cash. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—As early as April 15 the market was exhibiting signs of being in a sold-out condition, at least insofar as the market outside of the U. S. Metals Selling Company is concerned. On April 21 several millions of pounds of electrolytic were sold to European buyers at prices corresponding to 11.95@12c., f.o.b. New York. The advance in the London standard market which then set in and continued up to April 24, stirred

LONDON

Apr.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
20	53 11/16	54¼	57¼	194¼	189⅝	12⅞	23¾
21	54	54⅝	57¼	194⅝	189¾	12 13/16	24
22	.....	.....	.....	.....	.....	.....	.....
24	54 3/16	55⅛	58	196⅜	193⅜	12 13/16	24
25	54 7/16	55	58¼	195¼	190¼	12 13/16	24
26	54⅜	54¾	58¼	194¾	190½	12⅞	24

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

up European buyers somewhat, but the demand was met at prices only a trifle higher than those which had been realized before. Such advancing tendency as was manifest was checked on April 24, when it was reported that the principal seller had reduced its price to 12¼c., delivered, usual terms, and had made liberal sales. In Lake copper there were more general transactions than for some time past, sales having been made around 12¼c., with the metal freely offered at 12⅜, delivered. At the close the market is somewhat easier. Lake copper is quoted at 12⅛@12⅜c. and electrolytic copper in cakes, wirebars and ingots at 12@12.10c. Casting copper is quoted nominally at 11¾@12 cents.

Copper sheets are 18@19c. base for large lots. Full extras are charged, and higher prices for small quantities. Copper wire is 13¾c. base, carload lots at mill. Business is quiet in both sheets and wire.

The standard market has been firm and active. On April 21, three months advanced to £54 12s. 6d., and on April 24 it reached £55 2s. 6d. The market closes at £54 2s. 6d. for spot, and £54 15s. for three months. There has been more activity in the London standard market this week than for some time past.

Copper exports from New York for the week were 8512 long tons. Our special correspondent gives the exports from Baltimore for the week at 2601 tons.

E. P. Earle sells the copper output of the South Utah company.

Tin—A good deal of firmness was displayed by the London market during the past week. The available stocks are owned by members of the Syndicate, who naturally advance their prices as soon as any demand for spot material appears. The bears extend their operations to three months' tin, sales of which were made at a discount of £5 from spot. Little interest was shown in the London market by Americans, due mainly to the fact that the domestic market is so well provided for with spot material that it is being offered and sold below the importation basis. This condition will naturally change the moment stocks are again reduced to a normal state. The market closes weak in London at £194 15s. for spot, and £190 10s. for three months, and in New York at about 42.62½ cents.

Tin output of Federated Malay States, three months ended March 31, was 9420 long tons, a decrease of 1129 tons from last year.

Lead—The market is quiet and somewhat lower, Missouri lead being quoted at 4.22½@4.27½c. and New York at 4.40 cents.

The London market is somewhat higher, Spanish lead being quoted at £12 17s. 6d., and English at £13 per ton.

Spelter—The market is without special feature. There is a little business doing, and prices are unchanged at 5.22½@5.27½c. St. Louis, and 5.37½@5.42½c. New York.

The London market is strong; good ordinaries are quoted at £24, and specials at £24 5s. per ton.

Base price of zinc sheets $7.25 per 100 lb., f.o.b. La Salle-Peru, Ind., less 8 per cent. discount.

All of the zinc-smelting works at Bartlesville, Okla., have been closed by a strike. The men want an advance of 30c. per day all around; which would correspond to about 75c. per ton of ore smelted.

The Bethlehem works, of the New Jersey Zinc Company, are shortly to be closed and abandoned. All of the work of this company in the East is to be concentrated in Palmerton, the capacity of which is being increased.

Other Metals

Aluminum—The market is still quiet and quotations are 20½@21c. per lb. for No. 1 ingots. This is slightly below the parity of the foreign markets, which are reported stronger.

Antimony—The market has been quiet with business done only in a small way. Cookson's has been offered a shade lower, and is quoted at 9.40@9.60c. per lb. Other prices are 9@9⅛c. for U. S.; 8¼@8½c. for Hungarian, Chinese and other outside brands.

Quicksilver—Supplies are better, though spot is still scarce. Prices again show some reduction. New York quotation is $46.50 per flask of 75 lb. for large lots. San Francisco, $46 and $43.50 for domestic and export orders, respectively. London price is £9 per flask, with £8 15s. quoted by second hands.

Bismuth—The current price of bismuth in London is 7s. 6d.—or $1.80—per pound.

Cadmium—Current quotations are 60@70c. per lb. in 100-lb. lots, f.o.b. New York, according to quantity of metal. The price in Germany is 575@600 marks per 100 kg.; equal to 63.4c. per lb., average.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Nickel—Large lots, contract business, 40@50c. per lb. Retail spot, from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

Zinc and Lead Ore Markets

Joplin, Mo., April 22—The highest price paid for zinc sulphide ore was $44 per ton, the assay base price ranging from $37 to $41 per ton of 60 per cent. zinc for coarse ore and $36 for fines. Zinc silicate ore sold on a base of $22 to $24 per ton of 40 per cent. zinc. The average price, all grades of zinc, was $37.62. Lead ore was stronger again, with sales up to $58 and at least one sale at $59 per ton. The average price, all grades, was $56.54 per ton. Orders were for heavy purchasing and a large tonnage not yet shipped was included in advance sales this week, nearly all the smelters being represented by increased purchases. The zinc ore market would have a brightening

SHIPMENTS, WEEK ENDED APR. 22.

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	5,627,060	.....	999,350	$135,394
Joplin	2,484,540	.....	252,170	56,877
Galena	1,453,680	.....	99,530	30,405
Oronogo	633,220	.....	73,980	14,532
Duenweg	582,970	62,580	91,690	14,438
Miami	511,170	.....	198,510	13,835
Granby	423,730	207,180	17,610	9,930
Spring City	196,710	113,880	68,090	6,894
Aurora	323,560	66,010	.....	6,807
Alba-Neck	214,810	.....	.....	4,510
Jackson	210,530	.....	.....	4,210
Quapaw	117,850	.....	.....	1,885
Stott City	57,220	.....	15,000	1,492
Badger	75,470	.....	.....	1,433
Carl Junction	64,750	.....	.....	1,295
Sarcoxie	54,940	.....	.....	1,043
Cave Springs	52,630	.....	.....	999
Totals	13,084,840	449,650	1,815,930	$305,979
16 weeks	153,904,140	9,683,070	27,304,240	$3,939,153
Blende val., the week,	$249,651;	16 wks.,		$3,067,034
Calamine, the week,	4,991;	16 wks.,		115,230
Lead, the week,	51,337;	16 wks.,		756,889

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1910	1911	1910	1911	1910	1911
January	$47.31	$41.85	$45.16	$40.55	$56.99	$55.68
February	40.69	40.21	39.47	39.16	53.64	54.46
March	43.60	39.85	39.71	38.45	51.26	54.77
April	41.00	.....	39.33	.....	49.72	.....
May	40.19	.....	37.51	.....	48.16	.....
June	40.20	.....	37.83	.....	48.80	.....
July	39.63	.....	36.80	.....	48.59	.....
August	40.13	.....	37.32	.....	49.75	.....
September	43.45	.....	39.96	.....	54.73	.....
October	43.31	.....	40.50	.....	53.18	.....
November	47.20	.....	43.20	.....	54.80	.....
December	42.50	.....	40.70	.....	55.70	.....
Year	$42.43	.....	$39.79	.....	$52.12	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

outlook this week but for the strike spreading among smelter employees in Kansas and Oklahoma. Although this will be against the open market prices of zinc ore it should be a gain to the contract sellers, as the strike will undoubtedly advance spelter prices. The situation is reported here tonight as serious, with no immediate prospects for settlement. Three smelters at Bartlesville are out of commission and it is feared the strike will extend over the line in Kansas.

Platteville, Wis., April 22—The base price paid this week for zinc ore was $40 per ton of 60 per cent. zinc. The base price paid for 80 per cent. lead ore was $53@54 per ton.

SHIPMENTS, WEEK ENDED APR. 22

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point	766,300	.....	.....
Platteville	740,730	63,300	307,300
Galena	325,600	.....	.....
Shullsburg	175,200	55,000	.....
Harker	129,990	.....	.....
Hazel Green	82,300	.....	.....
Montfort	60,000	.....	.....
Livingston	.....	80,000	.....
Total	2,289,120	198,300	307,300
Year to date	41,585,870	2,418,935	10,531,290

Shipped during week to separating plants, 1,989,330 lb. zinc ore.

Other Ore Markets

Iron Ore—The price of Lake Superior iron ore has been apparently fixed by some large sales, though no formal agreement has been made. The prices are 50c. lower than last season, being as follows, f.o.b. Lake Erie docks: Bessemer ores—base 55 per cent. iron and under 0.45 phosphorus—$4.50 per ton for Old Range and $4.25 for Mesabi; nonbessemer—base 51.5 per cent. iron—$3.70 for Old Range and $3.50 for Mesabi.

Prices are also lower in the East and it is understood that both domestic and foreign ores have been offered at 25 or 50c. below last years' prices. A good 50 per cent. ore can be had at $3@3.50 per ton, at mine. In some cases, mines have assumed part of the freight also.

Manganese Ore—The base price, as fixed by large buyers, is 25c. per unit for manganese and 5c. per unit for iron content, for a base ore containing 49 per cent., or over in manganese, not over 0.20 phosphorus and 8 per cent. silica. Prices range down to 23c. per unit for 40 per cent. manganese; with deductions for excess of phosphorus and silica.

Pyrites—Domestic pyrites are quoted at 11½@12c. per unit of sulphur at mines for furnace sizes. Spanish pyrites, furnace sizes, are 12@12½c. per unit, ex-ship. Arsenical pyrites are from ½@1¼c. per unit less.

Tungsten Ore—Ferberite, wolframite and huebnerite ores, $6.50@7 per unit per ton of 2000 lb. of ore containing 60 per cent. of tungsten trioxide. For scheelite ore, 50c.@$1.50 per unit less.

Zinc Ores—For Rocky Mountain blende of good quality, especially as to iron and lead contents, the current price is for the zinc content, less 8 units, at the St. Louis price for spelter; with a deduction of $14@15 per 2000 lb. of ore. See also Joplin and Wisconsin ore markets.

CHEMICALS

New York, April 26—The general markets continue quiet as a rule, with only moderate business coming forward.

Copper Sulphate—Demand continues good, and $4.25@4.50 per 100 lb. is quoted for carload lots. For the day this is almost nominal, as spot supplies are very scarce; but it is probable that considerable supplies will be on the market soon.

Arsenic—The market remains dull, with quotations at $1.85@1.90 per 100 lb. for white arsenic. Supplies are abundant.

Nitrate of Soda—There is no change to report. Sales are fair and prices unchanged at 2.10c. per lb. for both spot and future positions.

MINING·STOCKS $

New York, April 26—The general stock market quickly passed through the spasm of activity noted last week, and relapsed into dullness. Small transactions and nearly stationary prices have been the rule.

There was one sale of Homestake, 100 shares changing hands at $85 per share.

The Curb market was also dull and slow, with small fluctuations. In the Cobalt stocks Kerr Lake was the only one attracting much interest. Moderate dealings in Braden Copper, Giroux, Inspiration and Greene-Cananea made up the market in the copper stocks. Everything else was dead.

The declaration of the usual ½ per cent. quarterly dividend by Amalgamated Copper aroused no interest.

Boston, April 25—Reports of large sales of copper caused quite a sharp rally in copper shares after a period of depressed prices. The break in the Wall Street market, which carried Amalgamated to $59.62½, brought sympathetic weakness to the local list and put many prices down to those reached in 1910. There was considerable belated liquidation.

Prominent in the break was Lake Copper, which touched $26.50. Hancock fell $4 to $18, while Calumet & Hecla broke $15 to $470, and Osceola $5 to $95. Copper Range made a low at $58.25. Mohawk touched $35 for a small lot and Tamarack fell $4 to $34. Superior fell $3 to $30. Lake, Nevada Consolidated and United States Smelting preferred sold the lowest since 1909. Osceola, Superior and Superior & Boston are the lowest since 1908; Isle Royale and Arizona Commercial since 1907. Mohawk has never been so low since 1904 and Centennial since 1902. In the case of Tamarack one will have to go back to 1885 to find as low a price as now.

Prices, however, recovered materially from the low points. Arizona Commercial spurted $1.50 today to $15 on word

COPPER PRODUCTION REPORTS

Copper contents of blister copper, in pounds

Company	January	February	March
Anaconda	21,000,000	20,900,000	21,900,000
Arizona, Ltd.	3,024,000	2,860,000	3,094,000
Balaklala	932,452	676,605	.....
Copper Queen	7,298,227	7,114,278	7,333,629
Calumet & Ariz.	2,044,000	1,762,000	1,960,000
Detroit	2,017,397	1,918,365	1,914,710
East Butte	1,134,000	1,065,000	.....
Imperial	.....	.....	.....
Nevada Con.	5,268,954	4,992,553	5,932,259
Old Dominion	2,095,000	1,890,000	2,563,000
Shannon	1,250,000	1,166,000	1,322,000
Superior & Pitts.	2,014,000	1,808,000	2,540,000
United Verde*	3,000,000	2,800,000	3,000,000
Utah Copper Co.	6,707,116	7,329,326	7,260,267
Lake Superior*	15,700,000	17,750,000	20,000,000
Non-rep. mines*	13,900,000	12,600,000	.....
Total production.	87,385,146	86,032,127	.....
Imports, bars, etc.	18,648,920	23,935,222	.....
Total blister	106,034,066	109,967,349	.....
Imp. in ore & matte	5,377,700	5,981,487	.....
Total	111,411,766	115,948,836	.....
Brit. Col. Cos.:			
British Col. Copper	.....	767,470	.....
Granby	.....	1,633,300	.....
Mexican Cos.:			
Boleo	2,647,173	2,226,560	2,700,880
Cananea	3,504,000	3,906,000	3,542,000
Moctezuma	1,738,429	1,950,475	2,049,150

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.
*Estimated.

STATISTICS OF COPPER.

Month.	United States Product'n.	Deliveries, Domestic.	Deliveries for Export.
III, 1910	120,067,467	62,844,818	40,585,767
IV	117,477,639	67,985,951	31,332,434
V	123,242,476	59,305,222	45,495,400
VI	127,219,188	53,363,196	65,895,948
VII	118,370,003	56,708,175	59,407,167
VIII	127,803,618	67,731,271	61,831,780
IX	119,519,983	64,501,018	75,106,496
X	126,469,284	67,814,172	68,186,912
XI	119,353,463	60,801,992	67,424,316
XII	123,339,219	43,594,018	88,104,075
Year 1910	1,452,122,120	749,426,542	722,431,494
I, 1911	115,696,591	42,078,567	53,208,739
II	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,081,127

	VISIBLE STOCKS.		
	United States.	Europe.	Total.
IV, 1910	123,824,874	249,625,600	373,450,474
V	141,984,159	246,870,400	388,854,559
VI	160,425,973	239,142,400	399,568,373
VII	168,386,017	232,892,800	401,278,818
VIII	170,640,678	222,320,000	392,960,677
IX	168,881,245	218,444,800	387,326,045
X	148,793,714	211,276,800	360,070,514
XI	139,261,914	198,060,800	337,322,714
XII	130,389,069	193,200,000	323,589,069
I, 1911	122,030,195	236,629,120	358,649,315
II	142,439,490	236,992,000	379,431,190
III	156,637,770	233,385,600	390,023,370
IV	162,007,934	223,014,400	385,022,334

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. From Jan. 1, 1911, stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

that the company has made a rich strike at the 1000-ft. level Copper Range, North Butte and Lake Copper also responded to the bettered condition.

Trading on the Curb has been at a minimum and prices weak in the main. South Lake and Bohemia have been strong spots.

Assessments

Company	Delinq	Sale	Amt
Alpha Con., Nev.	May 9	May 31	$0.05
Andes, Cal.	May 2	May 23	0.10
Amer. M. Co., Ida.	May 6	May 27	0.001
Bell, Ida.	Apr. 29	June 6	0.04
Bonanza Mountain, Ida.	Apr. 28	May 27	0.001
Challenge, Cal.	Apr. 26	May 27	0.05
Confidence, Nev.	May 11	May 31	0.20
Ely Consolidated, Nev.	May 2	June 22	0.05
Exchequer, Cal.	Apr. 26	May 18	0.05
Gould & Curry, Nev.	May 12	June 1	0.10
Log Cabin, Ida.	Apr. 24	May 24	0.006
Miner Inv. Co., Ida.	Apr. 28	May 27	0.0015
Potosi, Nev.	May 8	May 31	0.10
Scorpion, Nev.	May 4	May 24	0.03
Seven Troughs, Nev.	May 15	June 2	0.0025
Sierra Nevada, Nev.	May 4	May 25	0.10
Silver Shield, Utah.	May 16	June 3	0.015
Swansea Consolidated, Utah	May 15	June 7	0.01
Tintic Central, Utah.	Apr. 12	.....	0.005
Tintic Standard, Utah.	Apr. 25	.....	0.005
Trans.-Continental, Ida.	May 3	May 27	0.002
Union Con., Nev.	Apr. 11	May 3	0.10
Utah-Arizona, Ariz.	May 20	May 31	0.005
Utah Consolidated, Utah.	May 20	June 10	0.01
Yankee Con., Utah.	May 1	.....	0.02
Yellow Jacket, Nev.	May 8	June 8	0.10

Monthly Average Prices of Metals

SILVER

Month.	New York.			London.		
	1909.	1910.	1911.	1909.	1910.	1911.
January	51.750	52.375	53.795	23.843	24.154	24.865
February	51.472	51.534	52.222	23.706	23.794	24.081
March	50.468	51.454	52.745	23.227	23.690	24.324
April	51.428	53.221	.....	23.708	24.483	.....
May	52.905	53.870	.....	24.343	24.797	.....
June	52.538	53.462	.....	24.166	24.651	.....
July	51.043	54.150	.....	23.519	25.034	.....
August	51.125	52.912	.....	23.588	24.428	.....
September	51.440	53.295	.....	23.743	24.567	.....
October	50.923	55.490	.....	23.502	25.596	.....
November	50.703	55.635	.....	23.351	25.680	.....
December	52.226	54.428	.....	24.030	25.160	.....
Total	51.502	53.486	.....	23.706	24.670	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	New York.				London, Standard.	
	Electrolytic		Lake.			
	1910.	1911.	1910.	1911.	1910.	1911.
January	13.620	12.295	13.870	12.680	60.923	55.604
February	13.332	12.256	13.719	12.611	59.388	54.970
March	13.255	12.139	13.586	12.447	59.214	54.704
April	12.733	.....	13.091	.....	57.238	.....
May	12.550	.....	12.885	.....	56.313	.....
June	12.404	.....	12.798	.....	55.310	.....
July	12.215	.....	12.570	.....	54.194	.....
August	12.490	.....	12.715	.....	55.733	.....
September	12.379	.....	12 668	.....	55.207	.....
October	12.553	.....	12.788	.....	56.722	.....
November	12.742	.....	12.914	.....	57.634	.....
December	12.581	.....	12.863	.....	56.769	.....
Year	12.738	.....	13.039	.....	57.054	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

TIN AT NEW YORK

Month.	1910.	1911.	Month.	1910.	1911.
January	32.700	41.255	July	32.695	.....
February	32.920	41.614	August	33.972	.....
March	32.403	40.157	September	34.982	.....
April	32.976	.....	October	36.190	.....
May	33.125	.....	November	36.547	.....
June	32.769	.....	December	38.199	.....
			Av. Year	34.123	.....

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis.		London.	
	1910.	1911.	1910.	1911.	1910.	1911.
January	4.700	4.483	4.582	4.334	13.650	13.009
February	4.613	4.440	4.445	4.266	13.328	13.043
March	4.459	4.394	4.307	4.238	13.063	13.122
April	4.376	.....	4.225	.....	12.641	.....
May	4.315	.....	4.164	.....	12.550	.....
June	4.343	.....	4.207	.....	12.688	.....
July	4.404	.....	4.291	.....	12.531	.....
August	4.400	.....	4.290	.....	12.513	.....
September	4.400	.....	4.289	.....	12.582	.....
October	4.400	.....	4.271	.....	13.091	.....
November	4.442	.....	4.314	.....	13.217	.....
December	4.500	.....	4.363	.....	13.197	.....
Year	4.446	.....	4.312	.....	12.920	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York.		St. Louis.		London.	
	1910.	1911.	1910.	1911.	1910.	1911.
January	6.101	5.452	5.951	5.302	23.350	23.887
February	5.569	5.518	5.419	5.368	23.188	23.276
March	5.637	5.563	5.487	5.413	23.031	23.016
April	5.439	.....	5.289	.....	22.469	.....
May	5.191	.....	5.041	.....	22.100	.....
June	5.128	.....	4.978	.....	22.094	.....
July	5.152	.....	5.002	.....	22.406	.....
August	5.279	.....	5.129	.....	22.800	.....
September	5.514	.....	5.364	.....	23.165	.....
October	5.628	.....	5.478	.....	23.900	.....
November	5.976	.....	5.826	.....	24.083	.....
December	5.624	.....	5.474	.....	24.019	.....
Year	5.520	.....	5.370	.....	23.050	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG.

	Bessemer.		Basic.		No. 2 Foundry.	
	1910.	1911.	1910.	1911.	1910.	1911.
January	$19.90	$15.90	$17.98	$14.40	$17.94	$14.75
February	18.96	15.90	17.21	14.50	17.38	14.81
March	18.53	15.90	16.93	14.65	17.00	14.96
April	18.28	.....	16.84	.....	16.75	.....
May	17.10	.....	15.94	.....	16.18	.....
June	16.52	.....	15.60	.....	15.53	.....
July	16.40	.....	15.40	.....	15.40	.....
August	16.09	.....	14.89	.....	15.16	.....
September	15.92	.....	14.73	.....	14.93	.....
October	15.90	.....	14.05	.....	14.88	.....
November	15.84	.....	14.26	.....	14.78	.....
December	15.90	.....	14.15	.....	14.65	.....
Year	$17.10	.....	$15.65	.....	$15.83	.....

STOCK QUOTATIONS

COLO. SPRINGS Apr. 25

Name of Comp.	Bid.
Acacia	.03
Cripple Cr'k Con.	.01½
C. K. & N.	.14
Doctor Jack Pot	.05
Elkton Con.	.60
El Paso	.59
Findlay	‡.05
Gold Dollar	.11
Gold Sovereign	.02⅜
Isabella	.10
Jack Pot	.05
Jennie Sample	.10‡
Lexington	‡.01
Moon Anchor	.02½
Old Gold	‡.03
Mary McKinney	.30
Pharmacist	.01½
Portland	1.01
Vindicator	.80
Work	‡.02½

SALT LAKE Apr. 25

Name of Comp.	Bid.
Beck Tunnel	.28½
Black Jack	.16½
Carisa	.18
Cedar Talisman	.08½
Colorado Mining	.51
Columbus Con.	.31
Daly Judge	‡4.45
Grand Central	.90
Iron Blossom	1.27½
Little Bell	.45
Lower Mammoth	.10½
Mason Valley	7.50
May Day	.19
Nevada Hills	2.75
New York	.08½
Prince Con	.49
Silver King Coal'n	1.67½
Sioux Con.	.35
Uncle Sam	.65
Yankee	.16

TORONTO Apr. 25

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	6.70	Dome Exten.	.51½
Hudson Bay	1	Pearl Lake	.50
Temiskaming	.74	Dobie	2.90
Wettlaufer-Lor.	.85	West Dome	2.10
Hollinger	9.80	Standard	.28
Preston E. D.	.34	Apex	.17½
Porcu. Gold	.52½	Canada	1.10
Porcu. Tisdale	.09¾	Crown Char.	.52
Imperial	.10	Carnation	.32
Central	.55	Swastika	.54

SAN FRANCISCO. April 25.

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.12	Belmont	6.12½
Belcher	.90	Jim Butler	.24
Best & Belcher	.34	MacNamara	.11
Caledonia	.44	Midway	.31
Challenge Con.	.22	Mont.-Tonopah	.73
Chollar	.15	North Star	.12
Confidence	.70	West End Con.	.55
Con. Virginia	1.40	Atlanta	.09
Crown Point	.87	Booth	.08
Gould & Curry	.20	C.O.D. Con	.08
Hale & Norcross	.26	Comb. Frac	.11
Mexican	4.65	Jumbo Extension	.26
Occidental	.66	Oro	.05
Ophir	1.80	Silver Pick	.04
Overman	.41	St. Ives	.17
Potosi	.35	Tramps Con.	.02
Savage	.31	Argonaut	1.70
Sierra Nevada	.40	Bunker Hill	‡6½
Union Con.	1.72	Cent. Eureka	1.47
Yellow Jacket	.55	So. Eureka	7.50

N. Y. EXCH. Apr. 25

Name of Comp.	Clg.
Amalgamated	63⅞
Am. Agri. Chem.	56
Am.Sm.&Ref.,com	74⅛
Am. Sm.& Ref., pf.	104½
Anaconda	38
Batopilas Min	2
BethlehemSteelpf	61⅜
Chino	22⅛
Comstock Tunnel	.27
Federal M.& S., pf.	60
Goldfield Con.	6⅛
Great Nor., ore ctf.	59½
Homestake	83½
Miami Copper	19¾
Nat'nalLead,com.	51⅛
National Lead, pf.	107⅛
Nev. Consol	18⅛
Pittsburg Coal, pf.	78
Ray Con	16¼
RepublicI&S,com.	30½
Republic I & S, pf.	93
SlossSheffi'd,com.	49½
Sloss Sheffield, pf.	‡105
Tennessee Copper	36¼
Utah Copper	44⅛
U. S. Steel, com.	73¾
U. S. Steel, pf.	119⅛
Va. Car. Chem.	59½

N. Y. CURB Apr. 25

Name of Comp.	Clg.
Ariz.-Cananea	‡3⅜
Barnes King	‡.18
Braden Copper	3⅞
B. C. Copper	5⅛
Buffalo Mines	2.05
Butte Coalition	16⅞
Caledonia	⅝
Calumet & Mont.	‡.20
Cobalt Central	.06
Con. Ariz. Sm.	1⅛
Davis-Daly	1 1/16
Ely Con	1 1/16
Florence	1⅞
Giroux	6
Greene Cananea	6¼
Greenwater	.06
Guanajuato	‡3¼
Guerrero	‡1¼
Guggen. Exp.	188
Inspiration	6⅜
Internat. S. & R.	124
Kerr Lake	6⅛
La Rose	4½
McKinley-Dar-Sa.	1⅝
Min. Co. of A. new	4⅝
Moneta Porc.	.24
Mont. Shoshone	‡.04
Nev. Utah M. & S.	5/8
Nipissing Mines	10½
Ohio Copper	1 1/16
Pacific Sm. & M.	¾
Precious Metals	1/16
Ray Central	1⅜
Red Warrior	1 1/16
South Utah M. & S.	1/16
Standard Oil	663
Stewart	1⅛
Tonopah	6¾
Tonopah Ex.	1⅜
Tri-Bullion	1/16
Tularosa	1/16
Union Mines	¼
Yukon Gold	4

LONDON Apr. 26

Name of Com.	Clg.
Camp Bird	£1 12s 1½d
Dolores	1 10 0
El Oro	1 4 6
Esperanza	1 12 6
Mexico Mines	7 8 9
Oroville	0 6 0
Stratton'sInd.	0 2 3
Tomboy	0 15 3

BOSTON EXCH. Apr. 25

Name of Comp.	Clg.
Adventure	4¾
Algomah	7¼
Allouez	30
Am. Zinc	23⅜
Arcadian	2¼
Arizona Com.	15
Atlantic	4⅛
Bonanza	½
Boston & Corbin	12
Butte & Balak	5
Calumet & Ariz.	48⅞
Calumet & Hecla	472
Centennial	11½
Con. Mercur	.08
Copper Range	60⅛
Daly-West	4½
East Butte	11¼
Franklin	9
Granby	31
Hancock	20¼
Hedley Gold	15
Helvetia	1
Indiana	11½
Isle Royale	13
Keweenaw	2⅛
Lake	29⅜
La Salle	3¾
Mass	5¾
Michigan	1¾
Mohawk	38
New Arcadian	2
North Butte	27⅞
North Lake	5
Ojibway	5¼
Old Dominion	37
Osceola	100
Parrot	11
Quincy	66½
Shannon	10¼
Shattuck-Ariz.	17½
Superior	30¾
Superior & Bost.	3¼
Superior & Pitts.	14
Tamarack	35
Trinity	3½
U. S. Smelting	33½
U. S. Smelt'g, pf.	45¾
Utah Apex	2¾
Utah Con.	13½
Victoria	1¾
Winona	6½
Wolverine	110
Wyandot	1¼

BOSTON CURB Apr. 25

Name of Comp.	Last
Ahmeek	160
Bingham Mines	1½
Boston Ely	1
Boswyocolo	.08
Cactus	.12
Calaveras	2
Champion	.01½
Chief Cons	1⅞
Corbin	3⅛
Cortez	1½
Crown Reserve	3½
First Nat. Cop.	1½
Live Oak	15
Mackinaw	‡.02
Majestic	.42
Nat'l Mine & Ex.	.01
Nevada-Douglas.	2
Oneco	1½
Raven Copper	.21
Rhode Island Coal	3½
San Antonio	‡3½
South Lake	5
Trethewey	.90
Tuolumne Copper	4⅞
United Zinc, pfd.	‡4½
Vulture	6½
Yuma	‡.02

‡Last quotation.